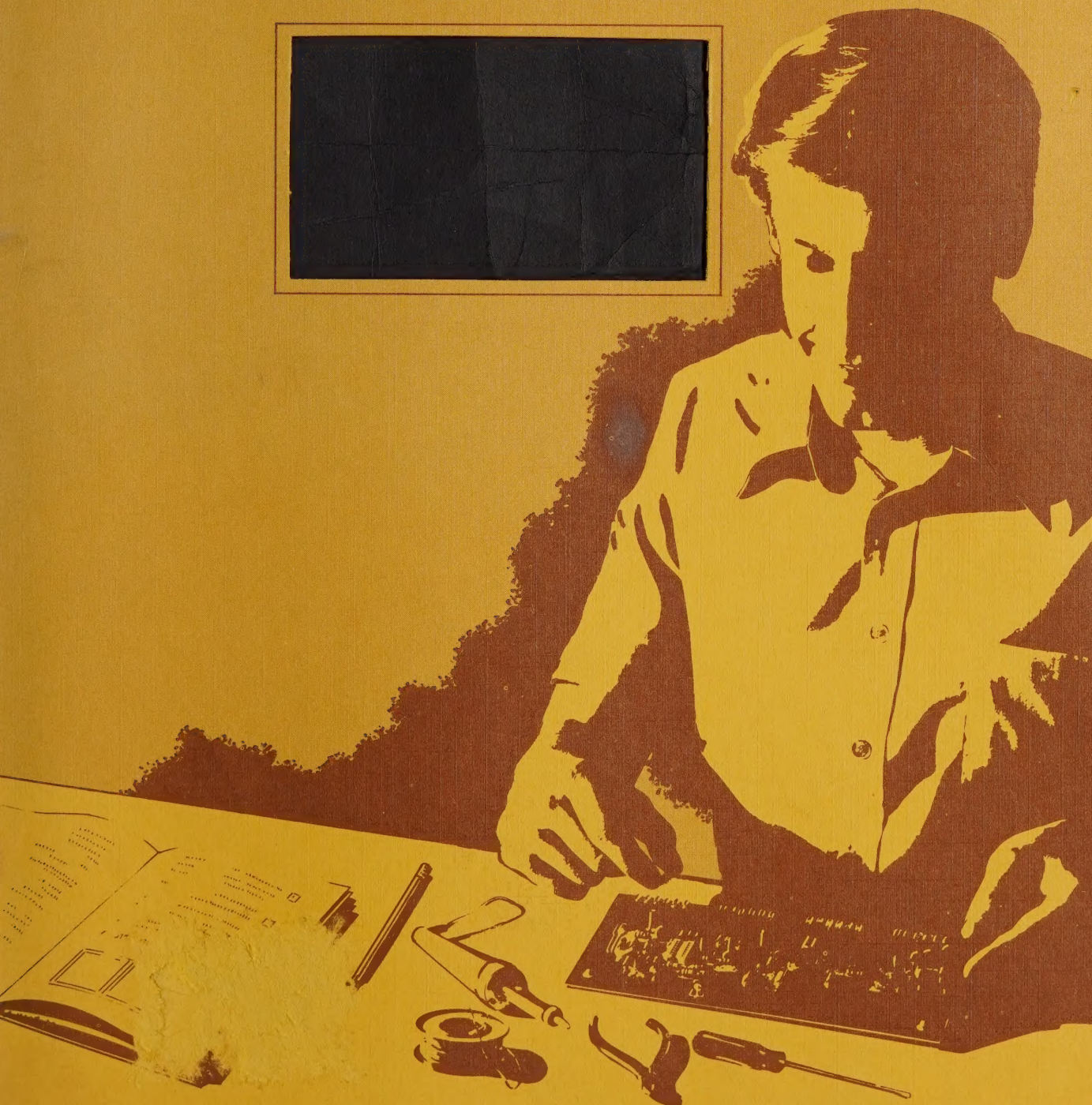


HEATHKIT[®] MANUAL



HEATH COMPANY • BENTON HARBOR, MICHIGAN

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HEATH COMPANY
BENTON HARBOR, MI. 49022

Heathkit® Manual

for the

COLOR TELEVISION BOOK THREE ADJUSTMENT AND OPERATION

Model GR-2001

595-1865-06

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BENTON HARBOR, MICHIGAN 49022

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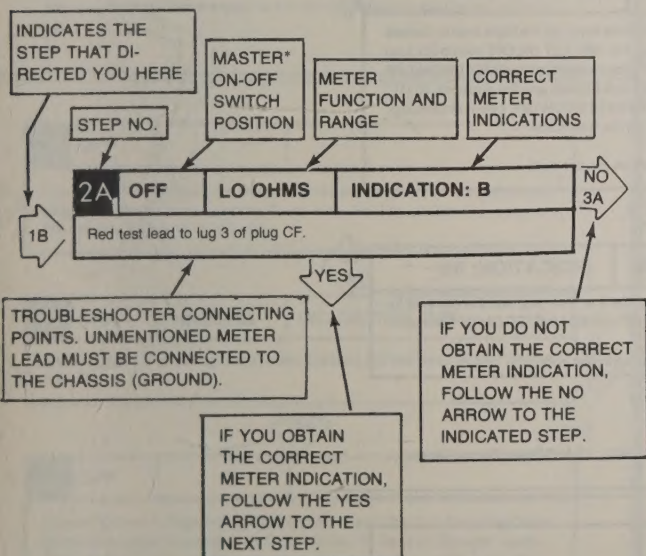
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RESISTANCE MEASUREMENTS

In this section of the Manual you will make preliminary resistance measurements with the Troubleshooter before you apply power to the TV Set. These measurements check the power supplies and their loads to prevent component damage that could occur due to wiring errors. Use **only** the Troubleshooter meter; other instruments may produce what appear to be inaccurate indications. **DO NOT PLUG THE LINE CORD OF THE TV SET INTO AN AC OUTLET UNTIL INSTRUCTED TO DO SO IN A STEP.**

Each set of measurements is in a chart that consists of several numbered steps. To complete the measurements in each chart, begin at START and connect the Troubleshooter as directed. Then, depending on the results of that step, proceed as directed by the YES arrow or the NO arrow. An example step is shown below.



These "Troubleshooting" steps are arranged in order from the most likely cause to the least likely.

Power to make measurements is supplied by the battery contained in the Troubleshooter. If the equipment being measured is turned on, you will either get inaccurate readings or possible damaged components in the Troubleshooter.

- () Place the Troubleshooter FUNCTION switch in the LO-OHMS position.
- () Connect the test leads together and verify that the meter pointer deflects full scale. If it does not, turn the OHMS ADJ control until the pointer is exactly over the "0" at the right side of the scale. If this does not happen, it is possible that the battery voltage is too low. Since the following readings are based on this 0 adjustment, it will be necessary to purchase another "AA" penlight battery for the Troubleshooter.

When only one test lead is mentioned in a step, always connect the unmentioned lead to the metal part of the ground strap at the picture tube socket (chassis ground). A poor ground may occur if the test lead is connected to the chassis itself because of the protective coating on the chassis parts.

NOTE: Hold the test leads on each test point long enough to obtain a stable meter indication. In some tests, the meter pointer might initially deflect full scale and then slowly decline before stopping. The final stabilized meter indication is shown for each test.

***WARNING:** When reading resistance, always have the TV Set unplugged.

In the following charts if a "B" meter indication is given, for example, it means that the Troubleshooter pointer should fall anywhere within the area B on the meter scale. A "B-C" meter indication means that the Troubleshooter pointer should fall anywhere within areas B or C on the meter scale.

If you are directed to Book 4, be sure to read the Introduction in Book 4 before making any tests. Also, read the Troubleshooter instructions for resistance measurements before attempting any readings.

Refer to the "Plug Location Charts" on Page 5-65 if you encounter a problem with the plugs or sockets.

POWER SWITCH CHECK

NOTE: Before you proceed with the following checks, refer to Figure 1-3 (Illustration Booklet, Page 1) and familiarize yourself with the front panel controls and switches.

Refer to Figure 1-1 (Illustration Booklet, Page 1), and 1-6 (Illustration Booklet, Page 2) for the test locations referred to in the following Resistance Measurement Charts.

NOTE: The pole piece assemblies (wrapped up or in a bag) that are connected to the convergence circuit board have not been installed yet. Do not allow the lugs of one assembly to touch the lugs of another when the TV Set is turned on.

()	1A	ON and OFF	HI-OHMS	INDICATION: INF	NO 2A
Connect the red test lead to one pin of the line cord and the black lead to chassis ground. The indication should be INF with the INSTANT ON/OFF switch ON (you may have to press this switch twice to find the on position) the MASTER ON/OFF switch in both the OFF (counterclockwise until it clicks) and ON positions. NOTE: The switch will always be referred to as the MASTER ON/OFF switch even though it is screened ON/OFF-BRIGHTNESS on the front panel. Repeat the procedure with the other pin on the line cord.					
↓ YES ↓					
()	1B	ON and OFF	HI-OHMS	INDICATION: INF	NO 2A
Connect the black test lead to one pin of the line cord plug and the red lead to chassis ground. The indication should be INF with the MASTER ON/OFF switch in both the OFF and ON positions. Repeat the procedure with the other pin of the line cord.					
↓ YES ↓					

This completes the test. Proceed to the "-8 and -15-Volt Power Supply Check."

()	2A	OFF	CHECK
1A	Check for a wiring error on the pushbutton ON/OFF switch and the power transformer T701. Be sure the switch covers have not cut through the wire insulation. Then go back to step 1A.		

-8 AND -15-VOLT POWER SUPPLY CHECK

1A	OFF		
----	-----	--	--

Remove the power supply circuit board. Do not reinstall the board until you are instructed to do so. NOTE: You can leave the degaussing coil plugged in on the foil side of this board.

1B	OFF	HI-OHMS	INDICATION: INF
----	-----	---------	-----------------

Connect the red test lead to circuit board connector K, pin 18, and the black test lead to circuit board connector K, pin 17 on the power supply circuit board.

1C	OFF	HI-OHMS	INDICATION: A-B
----	-----	---------	-----------------

Connect the red test lead to the base (B) lead of transistor Q676 and the black test lead to the circuit board connector K pin 4 on the power supply circuit board.

1D	OFF	HI-OHMS	INDICATION: A
----	-----	---------	---------------

Connect the black test lead to **chassis plug** K, pin 18.

1E	OFF	HI-OHMS	INDICATION: C-D
----	-----	---------	-----------------

Connect the black test lead to **chassis plug** K, pin 16.

This completes the test. Proceed to the "25-Volt Power Supply Check" on Page 3-6.

2A	OFF		
----	-----	--	--

Proceed to Book 4, Page 4-35, and perform the steps in the "Power Supply Circuit Board Resistance Measurements Chart" in the "In Case of Difficulty" section. Then return to step 1B on this chart.

2B	OFF	HI-OHMS	INDICATION: INF
----	-----	---------	-----------------

Remove the U-V switching circuit board. Connect the test leads as they were in step 1D.

2C	OFF		
----	-----	--	--

Proceed to Book 4, Page 4-37 and perform the steps in the "U-V Switching Circuit Board Resistance Measurements Chart" in the "In Case of Difficulty" section. Then reinstall the U-V switching circuit board and return to step 1D on this chart.

()	2D	OFF	HI-OHMS	INDICATION: INF
-----	----	-----	---------	-----------------

1E Unplug plug P36. Connect the test leads as they were in step 1E.

()	2E	OFF	HI-OHMS	INDICATION: C-D
-----	----	-----	---------	-----------------

Connect the black test lead to plug P204, pin 4.

()	2F	OFF		
-----	----	-----	--	--

Check the wiring between P36-34 and P204-4. Reinstall plug P36 and return to step 1E on this chart.

()	3A	OFF	CHECK	
-----	----	-----	-------	--

2B Check the wiring associated with circuit board connector K, pin 18. Then reinstall the U-V switching circuit board and return to step 1D on this chart.

()	3B	OFF	CHECK	
-----	----	-----	-------	--

2D Check the wiring associated with **chassis plug** K, pin 16. Then reconnect plug P9 and return to step 1E on this chart.

()	3C	OFF	HI-OHMS	INDICATION: C-D
-----	----	-----	---------	-----------------

2E Remove the display circuit board. Connect the black test lead to plug P204, pin 4.

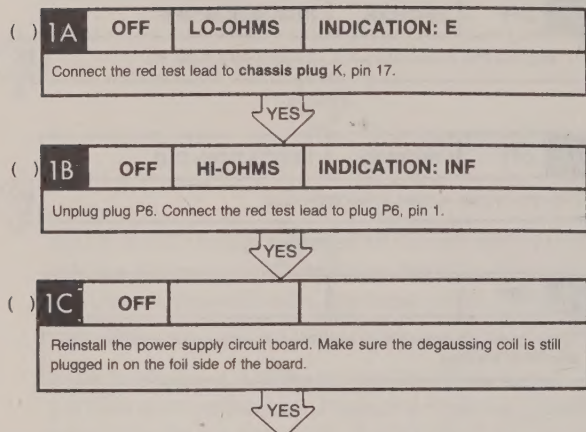
()	3D	OFF	CHECK	
-----	----	-----	-------	--

Check the foil and components associated with the -8V input (S212, pin 10) on the display circuit board. Then reconnect plug P36 and reinstall the display circuit board. Then return to step 1E on this chart.

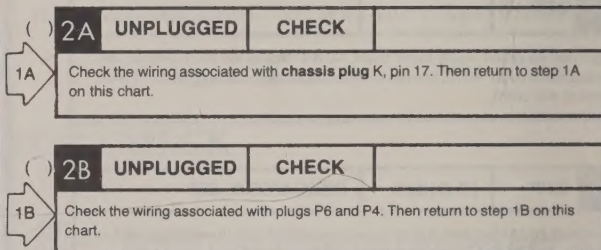
()	4A	OFF		
-----	----	-----	--	--

3C Check the foil and components associated with the -8V input (S204, pin 4) and output (P212, pin 10) on the tuning control circuit board. Reconnect plug P36 and reinstall the display circuit board. Then return to step 1E on this chart.

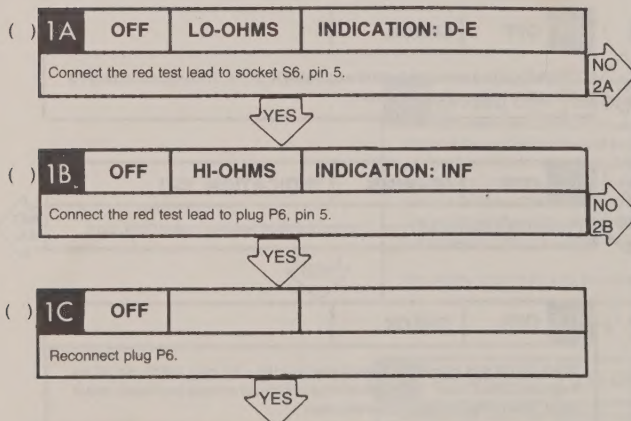
25-VOLT POWER SUPPLY CHECK



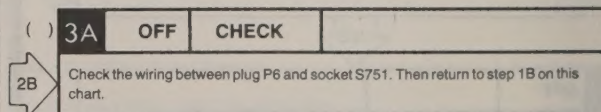
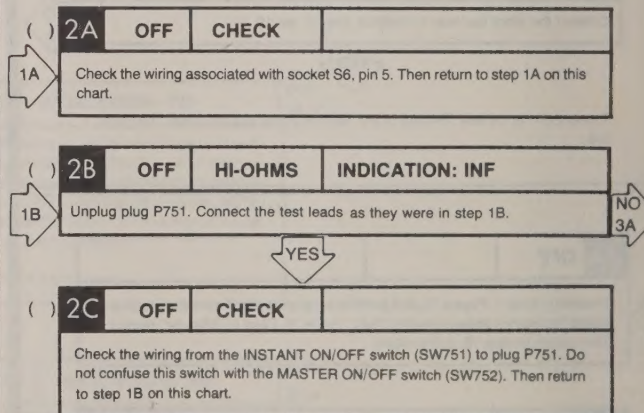
This completes the test. Proceed to the "190-Volt AC Power Supply Check."



190-VOLT POWER SUPPLY CHECK



This completes the test. Proceed to the "250-Volt Power Supply Check" on Page 3-7.



250-VOLT POWER SUPPLY CHECK

1A	OFF	HI-OHMS	INDICATION: B	NO 2A
----	-----	---------	---------------	----------

Connect the black test lead to power supply circuit board connector K, pin 12.

YES

1B	OFF	HI-OHMS	INDICATION: A-B	NO 2C
----	-----	---------	-----------------	----------

Connect the red test lead to power supply circuit board connector K, pin 10; and the black test lead to power supply circuit board connector K, pin 11.

YES

This completes the test. Proceed to the "160-Volt Power Supply Check" on Page 3-8.

2A	OFF	HI-OHMS	INDICATION: INF	NO 3A
----	-----	---------	-----------------	----------

Remove the power supply circuit board. Disconnect the degaussing coil from the foil side of the circuit board. Connect the black test lead to chassis plug K, pin 12.

YES

2B	OFF	HI-OHMS	INDICATION: B-C	NO 3B
----	-----	---------	-----------------	----------

Connect the black test lead to chassis plug K, pin 11.

YES

2C	OFF			
----	-----	--	--	--

Remove the power supply circuit board. Proceed to Book 4, Page 4-35, and perform the steps in the "Power Supply Circuit Board Resistance Measurements" chart in the "In Case of Difficulty" section. Then reinstall the power supply circuit board and return to step 1B on this chart.

()	3A	OFF	CHECK	
-----	----	-----	-------	--

2A Check the wiring associated with chassis plug K, pin 12. Check to see that diode D689 and capacitor C706 are installed correctly. Then reconnect the degaussing coil, reinstall the power supply circuit board, and return to step 1A on this chart.

()	3B	OFF	HI-OHMS	INDICATION: B-C	NO 4A
-----	----	-----	---------	-----------------	----------

2B Remove the video output circuit board. Connect the black test lead to chassis plug K, pin 11.

YES

()	3C	OFF		
-----	----	-----	--	--

Proceed to Book 4, Page 4-39, and perform the steps in the "Video Output Circuit Board Resistance Measurements" chart in the "In Case of Difficulty" section. Then reconnect the degaussing coil, reinstall all circuit boards, and return to step 1A on this chart.

()	4A	OFF	HI-OHMS	INDICATION: B-C	NO 5A
-----	----	-----	---------	-----------------	----------

3B Remove the service circuit board. Connect the black test lead to chassis plug K, pin 11.

YES

()	4B	OFF		
-----	----	-----	--	--

Proceed to Book 4, Page 4-40, and perform the steps in the "Service Circuit Board Resistance Measurements" chart in the "In Case of Difficulty" section. Then reconnect the degaussing coil, reinstall all circuit boards, and return to step 1A on this chart.

()	5A	OFF	CHECK	
-----	----	-----	-------	--

4A Check all the wiring and components associated with chassis plug K, pin 11. Then reconnect the degaussing coil, reinstall all circuit boards, and return to step 1A on this chart.

160-VOLT POWER SUPPLY CHECK

()	1A	OFF	LO-OHMS	INDICATION: A
Connect the black test lead to power supply circuit board connector K, pin 3.				

NO
2A

YES

()	1B	OFF	LO-OHMS	INDICATION: A
Connect the red test lead to power supply circuit board, connector K, pin 2; and the black test lead to power supply circuit board plug K, pin 1.				

NO
2A

YES

Proceed to Book 4, Page 4-46, and complete the resistance measurements under "Socket S626" and "Plug P626."

YES

This completes the test. Proceed to the "77-Volt Power Supply Check."

()	2A	OFF	HI-OHMS	INDICATION: INF
1A 1B	Remove the power supply circuit board. Connect the black test lead to chassis plug K , pin 2.			

NO
3A

YES

()	2B	OFF	LO-OHMS	INDICATION: A
Connect the black test lead to chassis plug K , pin 1.				

NO
3B

YES

()	2C	OFF		
Proceed to Book 4, Page 4-35, and perform the steps in the "Power Supply Circuit Board Resistance Measurements" chart in the "In Case of Difficulty" section. Then reinstall the power supply circuit board and return to step 1A on this chart.				

()	3A	OFF	CHECK	
2A	Check the wiring associated with chassis plug K , pins 2 and 3. Then reinstall the power supply circuit board and return to step 1A on this chart.			

()	3B	OFF	LO-OHMS	INDICATION: A
2B	Remove the horizontal oscillator circuit board. Connect the black test lead to chassis plug K , pin 1.			

NO
4A

YES

()	3C	OFF		
Proceed to Book 4, Page 4-45, and perform the steps in the "Horizontal Oscillator Circuit Board Resistance Measurements" chart in the "In Case of Difficulty" section. Then reinstall all circuit boards and return to step 1A on this chart.				

()	4A	OFF	LO-OHMS	INDICATION: A
3B	Unplug socket S626 (see lower right corner of Figure 1-6). Connect the black test lead to chassis plug K, pin 1.			

NO
5A

YES

()	4B	OFF		
Proceed to Book 4, Page 4-46, and perform the steps in the "High Voltage Assembly Resistance Measurements" chart in the "In Case of Difficulty" section. Then reconnect socket S626, reinstall all circuit boards, and return to step 1A on this chart.				

()	5A	OFF	LO-OHMS	INDICATION: A
4A	Unplug the yoke plug. Connect the black test lead to chassis plug K , pin 1.			

NO
6A

YES

()	5B	OFF	CHECK	
Check the wiring associated with the yoke plug and yoke socket. Then reconnect all plugs, reinstall all circuit boards, and return to step 1A on this chart.				

()	6A	OFF	LO-OHMS	INDICATION: A
5A	Unplug the convergence plug. Connect the black test lead to chassis plug K , pin 1.			

NO
7A

YES

()	6B	OFF	CHECK	
Check the wiring associated with the convergence plug and convergence socket. Then reconnect all plugs, reinstall all circuit boards, and return to step 1A on this chart.				

()	7A	OFF	CHECK	
6A	Check all wiring associated with chassis plug K pin 1. Check capacitor C706 and choke L701 for proper installation. Then reconnect all plugs, reinstall all circuit boards, and return to step 1A on this chart.			

77-VOLT POWER SUPPLY CHECK

()	1A	OFF	LO-OHMS	INDICATION: A-B	
Connect the black test lead to power supply circuit board connector K, pin 8.					NO 2A

YES

()	1B	OFF	LO-OHMS	INDICATION: A	
Connect the red test lead to power supply circuit board connector K, pin 9; and the black test lead to power supply circuit board connector K, pin 7.					NO 2A

YES

This completes the test. Proceed to the "24-Volt Power Supply Check" on Page 3-10.

()	2A	OFF	HI-OHMS	INDICATION: B-C	
Remove the power supply circuit board. Connect the black test lead to chassis plug K , pin 8.					NO 3A

YES

()	2B	OFF	LO-OHMS	INDICATION: A	
Connect the black test lead to chassis plug K , pin 7.					NO 3B

YES

()	2C	OFF			
Proceed to Book 4, Page 4-35, and perform the steps in the "Power Supply Circuit Board Resistance Measurements" chart in the "In Case of Difficulty" section. Then reinstall the power supply circuit board and return to step 1A on this chart.					

()	3A	OFF	CHECK		
Check all the wiring associated with chassis plug K , pins 8 and 9. Then reinstall the power supply circuit board and return to step 1A on this chart. IF NO WIRING ERROR IS FOUND, REFER TO NOTE #1 UNDER 3C.					

()	3B	OFF	LO-OHMS	INDICATION: A	
Unplug the vertical circuit board. Connect the black test lead to chassis plug K , pin 7.					NO 5A

YES

()	3C	OFF			
Proceed to Book 4, Page 4-34, and complete the measurements under "S523" and "P523." Reinstall the power supply circuit board, and return to step 1A on this chart.					

NOTE:

1. If no wiring error is found, there is an error in the 24-Volt supply. Proceed as though you obtained a "yes" for step 1B.

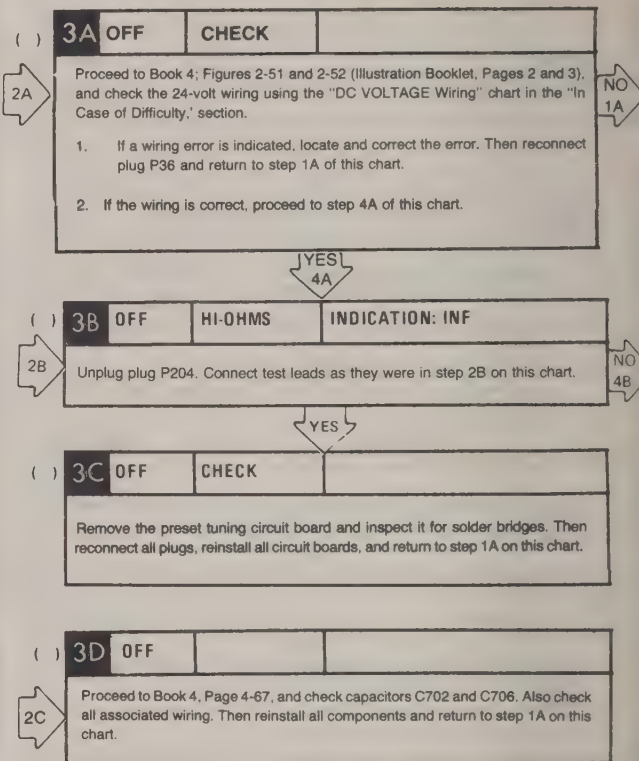
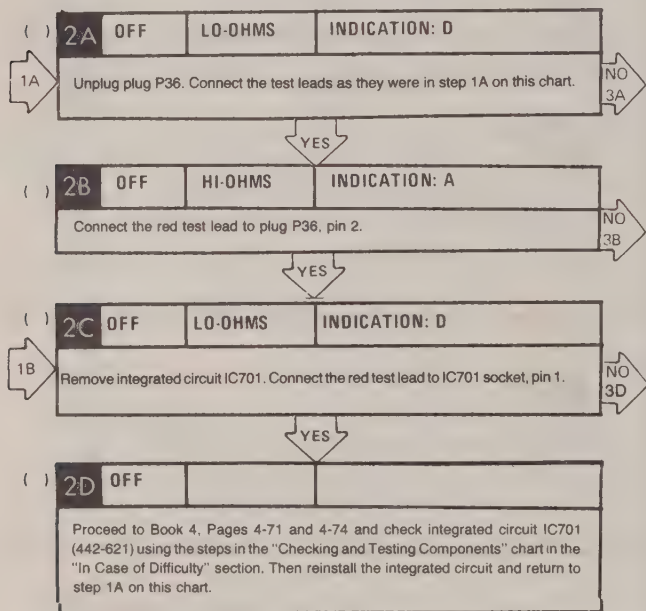
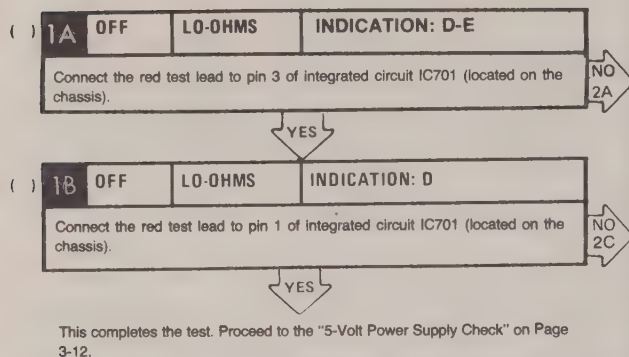
()	5A	OFF	LO-OHMS	INDICATION: A	
Disconnect socket S626. Connect the black test lead to chassis plug K , pin 7.					NO 6A

YES

()	5B	OFF			
Proceed to Book 4, Page 4-46, and perform the steps in the "High Voltage Assembly Resistance Measurements" chart in the "In Case of Difficulty" section. Then reconnect all sockets, reinstall all circuit boards, and return to step 1A on this chart.					

()	6A	OFF	CHECK		
Check all wiring and components associated with chassis plug K , pin 7. Then reconnect all sockets, reinstall all circuit boards, and return to step 1A on this chart.					

24-VOLT POWER SUPPLY CHECK



() 4A OFF LO-OHMS

Connect the test leads as they were in step 1A on this chart. Then remove the circuit boards, one at a time, as they are listed below until you obtain a YES indication. Then return to step 2E on this chart. If you obtain a NO indication for the last board listed, proceed to step 5A on this chart.

CIRCUIT BOARD	INDICATION
Video Output	D
Color Oscillator	D
Chroma	D
Sound	D
Luminance	D
IF	D
AGC/SYNC	C-D
U-V Switching	C
Horizontal	C
Vertical	C

YES 2E

() 4B OFF CHECK

Check all the wiring associated with plug P36, pins 21 and 22; and plug P205, pin 8. Then reconnect all plugs, reinstall all circuit boards, and return to step 1A on this chart.

() 4C OFF CHECK

Check the wiring from plug P36, pin 22 to circuit board plug N, pin 10. Then reconnect all plugs, reinstall all circuit boards, and return to step 1A on this chart.

() 5A OFF LO-OHMS INDICATION: B

Remove integrated circuit IC701. Connect the red test lead to IC701, socket pin 3.

YES

() 5B OFF

Proceed to Book 4, Pages 4-71 and 4-74, and check integrated circuit IC701 (442-621) using the steps in the "Checking and Testing Components" chart in the "In Case of Difficulty" section. Then reconnect all plugs, reinstall all components and circuit boards, and return to step 1A on this chart.

() 6A OFF LO-OHMS INDICATION: B

5A Disconnect the blue wire from lug 1 of terminal strip TA on the vhf/uhf tuner. See Figure 1-2 below. Connect the test leads as they were in step 5A on this chart.

YES

6B OFF

Refer to Figure 1-2 below and check the mounting of 2-lug terminal strip TA. Make sure it is not turned 180°. Then proceed to Book 4 and check capacitor C701 and resistor R702 using the steps in the "Checking and Testing Components" chart on Page 4-65 in the "In Case of Difficulty" section. Then reconnect the blue wire and all plugs, reinstall all components and circuit boards, and return to step 1A on this chart.

() 7A OFF HI-OHMS INDICATION: INF

6A Disconnect the blue wire from the AFT assembly, pin 5. Connect the test leads as they were in step 5A on this chart.

YES

() 7B OFF

Proceed to Book 4 and perform the steps in the "AFT Assembly Resistance Measurements" chart on Page 4-47 in the "In Case of Difficulty" section. Then reconnect the blue wire and all plugs, reinstall all components and circuit boards and return to step 1A on this chart.

() 8A OFF HI-OHMS INDICATION: INF

7A Disconnect capacitor C704 from IC701 socket, pin 3. Connect the test leads as they were in step 5A

YES

() 8B OFF

Proceed to Book 4 and check capacitor C704 using the steps in the "Checking and Testing Components" chart on Page 4-65 in the "In Case of Difficulty" section. Then reconnect all wires and plugs, reinstall all components and circuit boards, and return to step 1A on this chart.

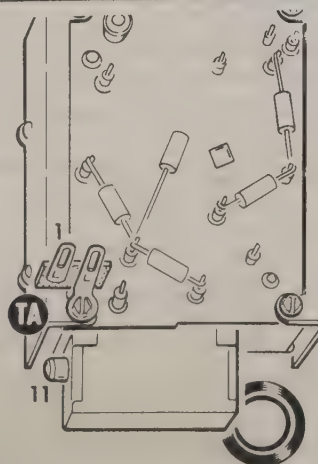


Figure 1-2

5-VOLT POWER SUPPLY CHECK

()	1A	OFF	LO-OHMS	INDICATION: A
Connect the black test lead to power supply circuit board connector K, pin 13.				

NO
2A

YES

()	1B	OFF	LO-OHMS	INDICATION: A
Connect the red test lead to power supply circuit board connector K, pin 15; and the black test lead to circuit board connector K, pin 14.				

NO
2A

YES

This completes the test. Proceed to Page 3-13.

()	2A	OFF	LO-OHMS	INDICATION: A
1A 1B	Remove the power supply circuit board. Connect the black test lead to chassis plug K, pin 14.			

NO
3A

YES

()	2B	OFF		
Proceed to Book 4 and perform the steps in the "Power Supply Circuit Board Resistance Measurements" chart on Page 4-35 in the "In Case of Difficulty" section. Then reinstall the power supply circuit board and return to step 1A on this chart.				

()	3A	OFF	HI-OHMS	INDICATION: INF
2A	Unplug plug P6. Connect the black test lead to chassis plug K, pin 13.			

NO
4A

YES

()	3B	OFF	HI-OHMS	INDICATION: A-B
Connect the black test lead to chassis plug K, pin 14.				

NO
4B

YES

()	3C	OFF	HI-OHMS	INDICATION: B-C
Connect the black test lead to plug P6, pin 4.				

NO
4C

YES

()	3D	OFF		
Proceed to step 4B on this chart.				

()	4A	OFF	CHECK	
3A	Check the wiring associated with chassis plug K, pins 13 and 15. Then reconnect plug P6, reinstall the power supply circuit board, and return to step 1A on this chart.			

()	4B	OFF	CHECK	
3B	Check the wiring associated with chassis plug K, pin 14. Then reconnect plug P6, reinstall the power supply circuit board, and return to step 1A on this chart.			

()	4C	OFF	HI-OHMS	INDICATION: INF
3C	Remove integrated circuit IC751. Connect the test leads as they were in Step 3C in this chart.			

NO
5A

YES

	4D	OFF		
Install new integrated circuit (#442-54) at IC702.				

()	5A	OFF	HI-OHMS	INDICATION: INF
4C	Remove transistor Q751. Connect the test leads as they were in step 3C in this chart.			

NO
6A

YES

()	5B	OFF		
1. Check for damaged mica insulator under Q751 on subchassis. 2. Install new transistor (#417-298) at Q751.				

()	6A	OFF	HI-OHMS	INDICATION: INF
5A	Remove plug P205. Connect test leads as they were in step 3C.			

NO
7A

YES

()	6B	OFF	CHECK	
Proceed to Book 4, Page 4-48, and perform the steps in the "Tuning Control Circuit Board Resistance Measurements" chart in the "In Case of Difficulty" section. Then reconnect all plugs, reinstall all components and circuit boards, and return to step 1A on this chart.				

()	7A	OFF	CHECK	
6A	Check all wiring associated with transistor Q751 and integrated circuit IC751. Then reconnect all plugs, reinstall all components and circuit boards, and return to step 1A on this chart.			

NORMAL OPERATING CHARACTERISTICS

This section of the Manual explains the normal operating characteristics of your Color TV Set. Since you will be observing the operation of your TV Set out of its cabinet, and you are concerned with its operation, the following conditions may appear to be difficulties. However, these operating conditions are normal for most color television receivers.

MASTER ON-OFF SWITCH

This TV has a memory circuit that "remembers" the channel that was selected when the set is turned off by the Instant On-Off switch. However, if the Master On-Off switch is turned off, the operating voltage to the memory circuit is also turned off. Then, when you turn the TV on it will select a random (most likely a different) station.

CHANNEL SELECTION

Entered channels that are not selected on the channel selection circuit board will cause the readout number to blink on and off and the screen to go black.

SNAPPING NOISE

An occasional snapping (arcing) may be heard during the first two weeks of operation. This arcing, which occurs between the elements of the color picture tube, is normal during the initial aging of the picture tube. NOTE: It is possible that this arcing could open the circuit breaker and turn the TV Set off or change the channel number. If the circuit breaker opens, push in the red button of the circuit breaker.

TRAILING EDGES OR GHOSTS ON LETTERS OR TITLES

Trailing edges or ghosts on letters or titles is a television signal transmission problem, or the antenna is off station slightly, and is not a fault of the TV Set. This is indicated by noticing that this condition will appear only on some channels and not on other channels.

NORMAL TRANSFORMER OPERATION

The power transformer T701 normally feels warm to the touch. This condition is caused by the normal heating of the transformer itself and by the heat radiated by the power transistors and some resistors in the TV Set. This was taken into consideration in the transformer design.

PRELIMINARY VOLTAGE READINGS

Refer to Figure 1-3 for the following steps.

Set the indicated front panel controls as follows:

- () R751: VOLUME — Extreme left.
- () SW752: R759: MASTER ON/OFF — Fully clockwise.
- () R153: COLOR — Extreme left.
- () R752: CONTRAST — Fully counterclockwise.

Refer to Figure 1-1 for the following steps.

Set the indicated subchassis controls and switches as follows:

FRONT PANEL CIRCUIT BOARD

- () R156: AGC Control — Center of rotation.
- () R158: COLOR KILLER — Fully clockwise.

DISPLAY CIRCUIT BOARD

- () SW50: DOTS/NORMAL switch — NORMAL.

Refer to Figure 1-6 and set the controls and switches on the chassis as follows:

NOTE: When you adjust vertically mounted controls on the circuit boards clockwise or counterclockwise, the controls should be viewed from the rotating side of the control. See the inset drawing on Figure 1-6.

LUMINANCE CIRCUIT BOARD

- () R392: BRIGHTNESS MINIMUM — Fully clockwise.
- () R417: BRIGHTNESS LIMITER — Fully counterclockwise.
- () SW401: NORMAL — RASTER — SERVICE switch — R (stamped on chassis).

VIDEO OUTPUT CIRCUIT BOARD

- () R441: BLUE DRIVE — Fully counterclockwise.
- () R443: GREEN DRIVE — Fully counterclockwise.
- () R442: RED DRIVE — Fully counterclockwise.

SERVICE CIRCUIT BOARD

- () SW604: KINE BIAS switch — 2 (stamped on chassis).
- () SW603: BLUE GUN switch — ON.
- () SW601: GREEN GUN switch — ON.
- () SW602: RED GUN switch — ON.

VERTICAL OSCILLATOR CIRCUIT BOARD

- () R530: VERTICAL FREQUENCY — Center of rotation.
- () R541: HEIGHT — Center of rotation.
- () R558: CENTERING — Center of rotation.

HORIZONTAL OSCILLATOR CIRCUIT BOARD

- () R578: HORIZONTAL FREQUENCY — Center of rotation.

CHASSIS MOUNTED CONTROLS

- () R728: BLUE SCREEN — Fully counterclockwise.
- () R730: GREEN SCREEN — Fully counterclockwise.
- () R729: RED SCREEN — Fully counterclockwise.
- () Remove transistor Q105, located on the AGC/SYNC circuit board, from its socket. Do not misplace the transistor. **NOTE:** With this transistor removed, the muting circuit is disabled. This means that the screen will not go black and the sound will not be squelched when you are switching channels.

PRELIMINARY VOLTAGE READING CHART

WARNING: Since high voltages are present at many points throughout the TV Set, be very careful to avoid personal shock.

NOTE: Read the entire procedure in the left-hand column before you begin the checks. Also, if you should get a NO result during any of these checks, turn the TV Set off immediately.

()	1A	OFF		
Unplug the picture tube socket.				

YES

()	1B	ON	VOLTS: 500	INDICATION: 150 - 160 VDC
Connect the red test lead to choke L701, lug 1, and plug in the line cord. If you do not obtain an indication, push and release the INSTANT ON/OFF switch. Be sure to read the bottom scale on the meter. NOTE: If you have Remote Control, the switch will be inoperative at this time.				

NO
2A

YES

()	1C	ON	VOLTS: 50	INDICATION: 35 VDC.
Connect the red test lead to test point TP572 on the horizontal oscillator board.				

NO
2G

YES

()	1D	ON	VOLTS: 500	INDICATION: 180 - 230 VDC
Connect the red test lead to video output circuit board connector 8, then 10, and then 11. The above indication should be at each of the three connectors.				

NO
2B

YES

()	1E	ON	VOLTS: 500	INDICATION: 200 VDC.
Place the NORMAL-RASTER-SERVICE switch in the N position. Connect the red test lead to video output circuit board connector 11. Adjust the BRIGHTNESS MINIMUM control for approximately 200 volts. If the voltage is less than 170 volts, refer to the "In Case of Difficulty" section.				

NO
2F

YES

()	1F	ON	VOLTS: 500	INDICATION: 250 VDC
Adjust the BRIGHTNESS control counterclockwise, but not so far that it clicks.				

NO
2F

YES

()	1G	ON	VOLTS: 500	INDICATION: 50-70 VDC
Connect the red test lead to service circuit board connector 2; then 3, and then 4. The above indication should be at each of the three connectors.				

NO
2D

YES

This completes the test. Unplug the line cord and disconnect the meter leads. Then proceed to the "Degaussing" section on Page 3-17.

()	2A	OFF		
1B	Return to the "Resistance Measurements" section and perform the steps on the "160-Volt POWER Supply Check" chart. Then return to step 1B on this chart.			

()	2B	ON	VOLTS: 500	INDICATION: 250 VDC
1D	Connect the red test lead to power supply circuit board connector 11.			

NO
3A

YES

()	2C	OFF		
Proceed to Book 4, Page 4-39, and perform the steps in the "Video Output Circuit Board" charts. Notes #1 and #2 do not apply when the N-R-S switch is in the R position. Return to step 1C on this chart.				

()	2D	ON	VOLTS: 500	INDICATION: 250 VDC
1G	Connect the red test lead to service circuit board connector 1.			

NO
3B

YES

()	2E	OFF		
Proceed to Book 4, Page 4-40, and perform the steps in the "Service Circuit Board Resistance Measurements" chart in the "In Case of Difficulty" section. Then return to step 1F on this chart.				

YES

()	2F	ON		
1E 1F	Proceed to Book 4, Page 4-43, and perform the steps in the "Luminance Circuit Board" charts. Also check the readings in the chart on pins 13 and 17 of plug P36 and socket S36. Then return to step 1D on this chart.			

()	2G			
1C	Proceed to Book 4, Page 4-45, and perform the steps in the "Horizontal Oscillator" and "High Voltage Assembly" circuit board charts.			

()	3A	OFF		
2B	Proceed to Book 4, Page 4-35, and perform the steps in the "Power Supply Circuit Board Resistance Measurements" chart in the "In Case of Difficulty" section. Then return to step 1C on this chart.			

()	3B	OFF	CHECK	
2D	Check the wiring associated with chassis plug A, pin 1. Then return to step 1F on this chart.			

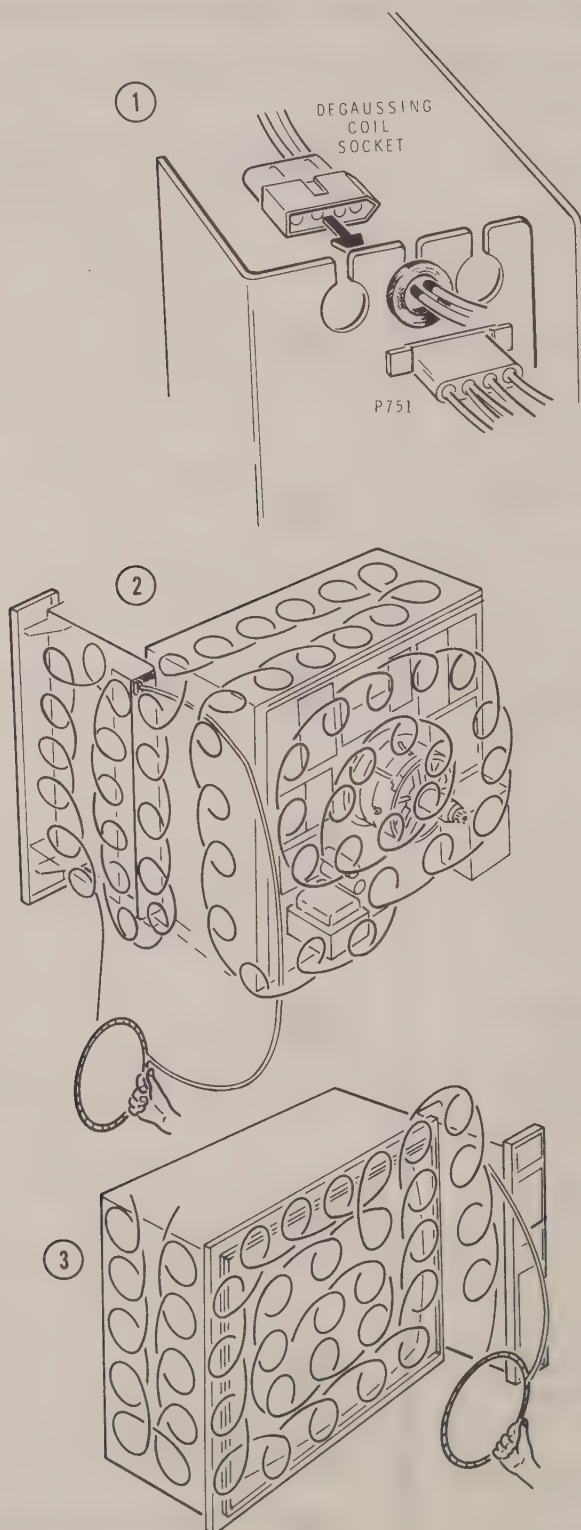


Figure 1-4

DEGAUSSING

The following degaussing process is used to remove stray magnetism from the picture tube and the metal objects around it. Even the very weakest magnetic field can cause distortion in the form of impure colors. The parts that must be degaussed (demagnetized) in your Color TV Set are the picture tube shield, the chassis, and the subchassis.

Refer to Figure 1-3 for the following steps.

Set the indicated front panel controls as follows:

- () VOLUME — Down.
- () MASTER ON/OFF— OFF (fully counterclockwise until it clicks).

WARNING: Use extreme care during the degaussing process, as the TV Set is in operation and high voltage is present at several locations. Do not touch any of the chassis components during the degaussing process.

If any sign of malfunctioning appears in the following steps, turn the TV Set off and refer to "In Case of Difficulty," Book 4. Prolonged operation of a malfunctioning set could result in damaged transistors, picture tube, or components.

CAUTION: The pole piece assemblies that are connected to the convergence circuit board, and the blue lateral and purity assembly that slides onto the neck of the picture tube have not been installed yet. Do not place the degaussing coil near either of these parts while power is applied to the coil. The magnetic field around the coil could affect the magnets of these parts.

- () Place the pole piece assemblies as far from the TV Set as the leads permit. Do not allow the lugs of one assembly to touch the lugs of another.

Refer to Figure 1-4 for the following steps.

- () Remove the socket from plug P751 on the rear of the subchassis.
- () Locate the degaussing coil and insert the socket on plug P751 as shown in drawing 1. If necessary, reform the degaussing coil into a circle.
- () Turn the glide latch locking screw out about 1/2". Then turn the glide latch counterclockwise and pull the subchassis out. See Figure 1-3.

NOTE: The degaussing coil will vibrate when turned on, and will also tend to get warm if left turned on for too long a period of time. The entire degaussing process should take no longer than one or two minutes. When you perform the degaussing process, move the coil in small circular motions near the objects being degaussed. Keep the coil parallel to, and at a distance of about one to two inches from, the objects being degaussed. When you have completed the degaussing process, move the coil away from the TV Set as far as the leads will permit before you turn the TV Set off.

- () Connect the line cord plug to a standard AC outlet.
- () Turn the degaussing coil on by turning the MASTER ON/OFF switch to the ON position.
- () Move the degaussing coil in a circular motion near the top and sides of the picture tube shield, the subchassis, the chassis, and the picture tube screen, as shown in drawings 2 and 3.
- () Move the degaussing coil as far away as possible from the TV Set; then turn the coil off by turning the MASTER ON/OFF switch to the OFF position.
- () Disconnect the line cord plug from the AC outlet.
- () Unplug the degaussing coil and set it aside.
- () Install socket S751 on Plug P751.
- () Push the subchassis in until it latches.

FINAL ASSEMBLY

CAUTION: When you install the pole piece assemblies in the following steps, do not push on the adjustment knobs, as they can be broken off very easily.

Refer to Pictorial 22-21 (Illustration Booklet, Page 3) for the following steps.

NOTE: Each pole piece assembly has four wires connected to it. One of these wires is a solid color (all blue, all red, or all green). This wire will be used to identify each pole piece assembly.

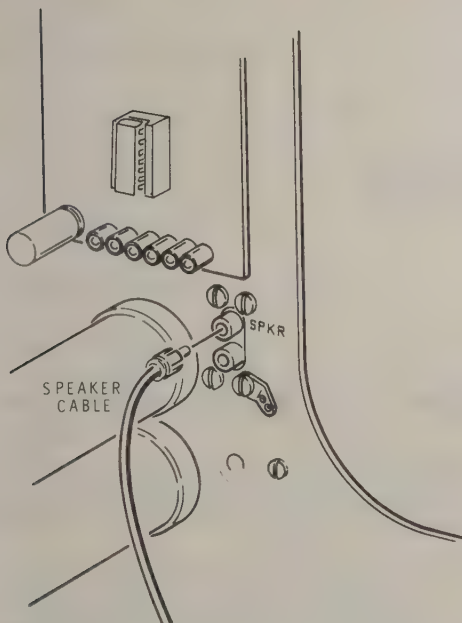
Refer to inset drawings #1 and #2 and install each of the three pole piece assemblies as follows: Position the pole piece as shown with the two magnets against **the neck of the picture tube** (between the yoke clamp and pole piece holder). Then push the pole piece in until the clip snaps in place. **IMPORTANT:** It is possible for the pole piece to get caught on a narrow lip inside the pole piece holder and prevent the magnets from touching the neck of the picture tube, see inset drawing #1. Check each pole piece after it is installed to make sure this has not happened.

- () Install the green pole piece assembly at location CH.
- () Install the blue pole piece assembly at location CG.
- () Install the red pole piece assembly at location CJ.

- () Check the position of the yoke mounting clamp and screw to be sure the **screw head and screw point are 3/16" from the lugs of the pole piece assemblies**. If necessary, loosen the screw and reposition the yoke mounting clamp (**See inset drawing #3.**)

NOTE: One of three blue lateral and purity assemblies (#100-1629) is furnished with your kit. Pictorial 22-22 (Illustration Booklet, Page 4) is a 3-part drawing showing the assemblies and the correct mounting of each. Choose the drawing that corresponds to your type of blue lateral and purity assembly. If you have type C, turn the blue lateral adjustment knob so the sliders are even at each end, as shown.

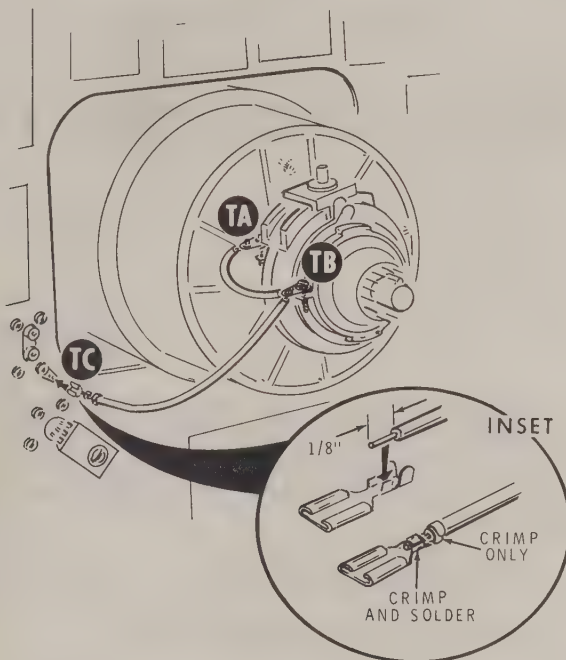
- () Remove the screw from the clamp on the blue lateral assembly. Then install a #8 solder lug on the screw, reinstall the screw in the clamp, and tighten it enough to hold the clamp in place. **NOTE:** This screw can be on either side. If it is on the opposite side shown in the Pictorial, place it as shown.
- () Install the blue lateral and purity assembly on the neck of the picture tube. Position this assembly as follows: position the blue lateral adjustment knob as shown; then position the purity rings 2" from the end of the picture tube base and tighten the hardware.



Detail 22-22A

CAUTION: The area of the blue lateral and purity assembly that contacts the neck of the picture tube may be coated with a heat-sensitive adhesive. If you have to remove the blue lateral and purity assembly for any reason after the TV Set has been in operation for some time, you can **twist** the assembly to break the adhesive contact. Do not pry the assembly from the neck of the picture tube as this could break the glass and destroy the tube.

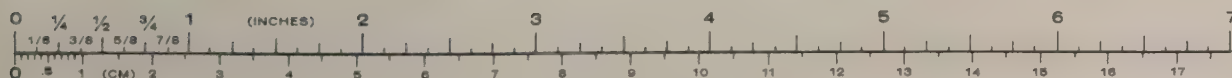
- () Push the picture tube socket on the base of the picture tube until it is against the base of the tube. NOTE: Be sure the socket is pushed tightly against the base of the tube.
- () Plug the speaker cable into the hole of the phono socket marked SPKR. Refer to Detail 22-22A.



Detail 22-22B

Refer to Detail 22-22B for the next three steps.

- () Connect a 6" black stranded wire between solder lugs TA (S-1) and TB (NS).
- () Install the push-on connector on one end of the remaining black stranded wire as shown in the inset drawing on Detail 22-22B.
- () Push the connector on solder lug TC. Connect the other end of the wire to solder lug TB (S-2).



TESTS AND ADJUSTMENTS

INITIAL SETUP

Refer to Figures 1-1 and 1-3 as you make the following adjustments. Also at this time, remove the loose "fold-in" of color photos that is inserted in Book #4. You may want to place it on top of the TV Set for easy reference.

Set all front controls as follows:

- () SW751: VOLUME — Extreme left.
- () R758: PEAKING — Center of rotation. You can reach this control by removing the knob of the CONTRAST control and inserting a narrow screwdriver into the hollow shaft.
- () R752: CONTRAST — Center of rotation.
- () SW755: AFT (Automatic Fine Tuning) — OFF.
- () SW754: MUTE — OFF.
- () SW752/R759: MASTER ON/OFF — Fully counterclockwise until it clicks.
- () R153: COLOR — Extreme left.
- () R154: TINT — Center.
- () R756: TONE — Center of rotation.
- () Set all of the controls (but not the coils) on the convergence circuit board to their centers of rotation.

Set the controls on the front panel circuit board as follows. Note that the 12-o'clock position is straight up, as shown in the inset drawing on Figure 1-1.

- () R156: AGC — 2-o'clock position.
- () R158: COLOR KILLER — Fully clockwise.

Set the controls on the display circuit board as follows:

- () R63: DISPLAY TIME — Center of rotation.
- () R53: HORIZONTAL POSITION — Center of rotation.
- () R55: VERTICAL POSITION — Center of rotation.

Set the switch on the display circuit board as follows:

- () SW50: DOTS-NORMAL switch — NORMAL.

Refer to Figure 1-6 and set the controls on the rear of the Set as follows:

SERVICE CIRCUIT BOARD

- () SW604: KINE BIAS — Position 2.
- () SW601: GREEN GUN — On.
- () SW602: RED GUN — On.
- () SW603: BLUE GUN — On.
- () R602: PINCUSHION AMP — Center of rotation.
- () R607: HORIZONTAL CENTERING — Center of rotation.

VIDEO OUTPUT CIRCUIT BOARD

- () R443, R442, R441: GREEN, RED, and BLUE DRIVE controls — Center of rotation.
- () R445: DISPLAY — Fully clockwise.

COLOR OSCILLATOR CIRCUIT BOARD

- () SW476: NORMAL-ADJUST switch — NORM.
- () R487: ACC — Center of rotation.
- () R491: APC — Center of rotation.

IF CIRCUIT BOARD

- () Place a piece of the foil tape over the hole in L311 so it will not accidentally be adjusted.

CHROMA CIRCUIT BOARD

- () Place a piece of the foil tape over the hole in T451 so it will not accidentally be adjusted.

LUMINANCE CIRCUIT BOARD

- () SW401: NORMAL-RASTER-SERVICE switch — N.
- () R417: BRIGHTNESS LIMITER — Fully clockwise. NOTE: Do not confuse this control with the BRIGHTNESS MINIMUM control.

AGC/SYNC CIRCUIT BOARD

- () R127: RF AGC — Fully clockwise.

U-V SWITCHING CIRCUIT BOARD

- () R187: UHF-AGC control — Fully counterclockwise.

HORIZONTAL OSCILLATOR CIRCUIT BOARD

- () R578: FREQUENCY ADJUST — Center of rotation.

VERTICAL OSCILLATOR CIRCUIT BOARD

- () R530: VERTICAL FREQUENCY — Center of rotation.
- () R558: CENTERING — Center of rotation.
- () R541: HEIGHT — Center of rotation.

CHASSIS

- () R730, R729, R728: GREEN, RED, and BLUE SCREEN controls — Center of rotation.

WARNING: Extremely high voltage (26,000 volts) is present in the horizontal output assembly and at the 2nd anode of the picture tube. Use extreme care that you do not touch any of these parts while the TV Set is in operation. A safe rule to remember when you work around high voltage is to use only one hand to work on the circuit and keep the other hand behind you. This helps prevent your body from becoming part of an electrical circuit by being connected from the high voltage to ground.

A capacitance between the inner and outer conductive coatings of the picture tube allows a high voltage charge to be stored at the high voltage anode. Be sure to discharge the picture tube as shown in Figure 1-7 (Illustration Booklet, Page 4) before connecting or disconnecting the high voltage anode connector.

- () Connect the lead-in wire or wires from your vhf and/or uhf antennas to the correct antenna terminals. See Page 3-46.

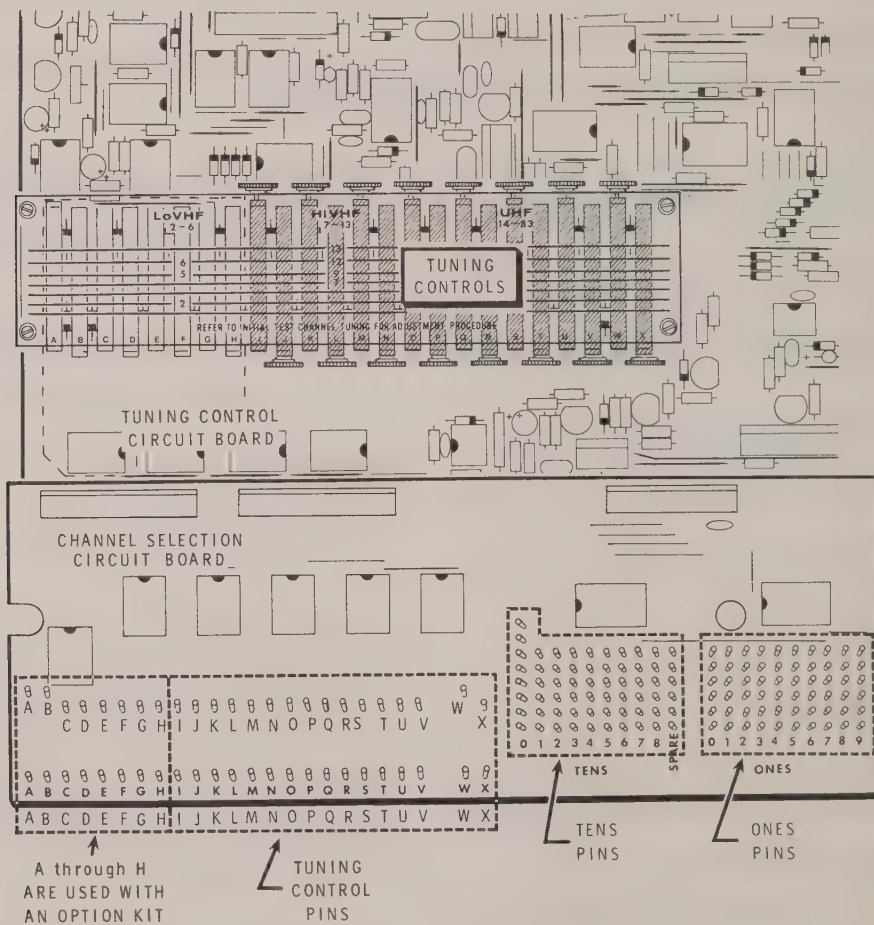


Figure 1-8

CHANNEL PROGRAMMING

INTRODUCTION

In this section you will program your television for the channels you receive in your area. This television has provisions to accept 16 channels (24 with the purchase of the option kit).

These channels can be either VHF or UHF. To program the channels, you will be working with the tuning control circuit board and the channel selection circuit board, which are mounted on the subchassis. Before you start the actual programming, read the following paragraphs, which explain the procedure in detail — starting with the tuning control circuit board.

Refer to Figure 1-8 for the following description:

TUNING CONTROL CIRCUIT BOARD

This circuit board has sixteen Tuning Controls. You will be instructed to label each control with the number of a channel received in your area. Then, after the programming is complete, you will use these controls to tune in the channels.

CHANNEL SELECTION CIRCUIT BOARD

On this circuit board, you will program the channel numbers in the sequence that you have selected.

Note the three groups of pins called out on Figure 1-8. These groups are identified as the TUNING CONTROL PINS, the TEN PINS, and the ONES PINS.

Tuning Control Pins

There are two rows of these pins. The bottom row is lettered A through X on the circuit board. However, the same letters identify the top row of pins also. Each pair of pins is related to a tuning control with the same letter. Pin X corresponds to control R216, pin W to R215, etc. Pins A through H are only used when you purchase the option kit from the Heath Company. This option kit allows you to program an additional eight channels.

Tens Pins

These groups of pins consist of 10 vertical rows. Each row is identified as 0 through 8 and SPARE. Pins 0 through 8 are used as the first digit in a television channel number. The SPARE pins will be explained under SPARE pin heading.

Ones Pins

This group of pins consists of ten vertical rows, 0 through 9. These numbers are used as the second digit in the channel number.

SPARE PINS

The SPARE pins can be used to increase any one of the vertical columns of pins (0 through 8 in the TENS group and 0 through 9 in the ONES group). EXAMPLE: You have used all of the pins in column 1 of the TENS group and you have more channels to program with a first digit of 1. By installing a jumper wire between any pin in column 1 with any pin in the SPARE column, you have 5 more number 1 pins to use. See the example in Figure 1-8A. IMPORTANT: This can be done with only one column in one group even though there are extra SPARE pins not being used. The SPARE pins are actually all common to one another since they are installed in one common foil pattern.

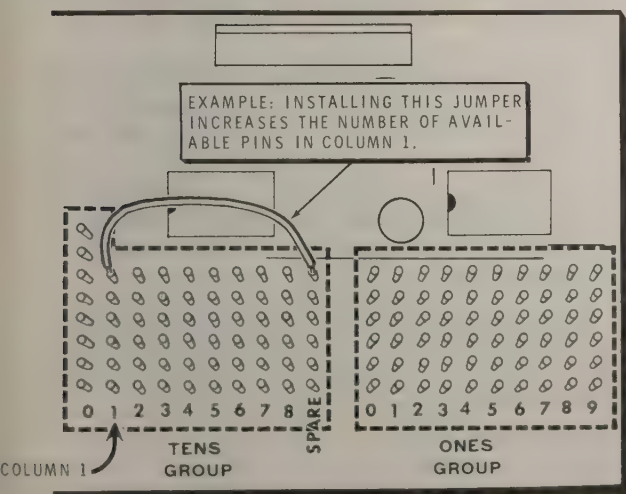


Figure 1-8A

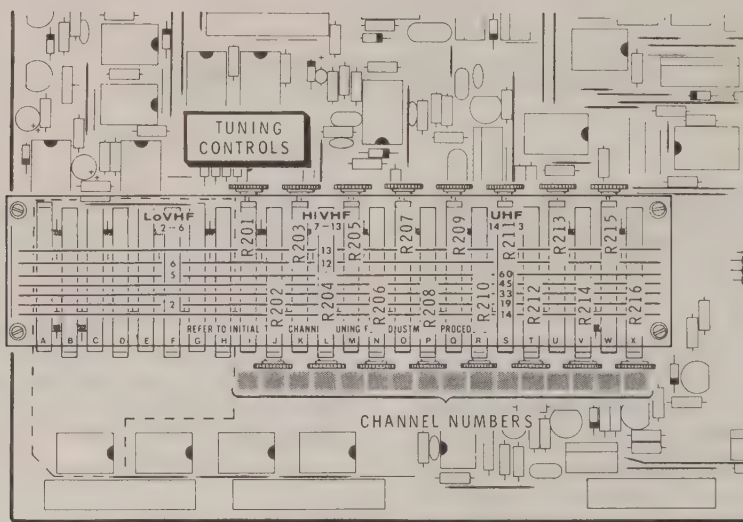


Figure 1-9

Refer to Figure 1-9 for the following steps.

- () Set the red pointer of each of the sixteen controls to the midrange position by turning the control knob.
- () Write down the vhf and uhf channels that are received in your area. The numbers do not have to be in numerical sequence.
- () Locate the sheet of channel numbers that you received with your parts (02 through 83).
- () Refer to the list of channels you recorded and peel off the first channel number from the sheet. Stick this number on the circuit board at the indicated end of control R216 (X).
- () Repeat this same procedure with control R215 (W) and the other controls that you have channel numbers for.

PROGRAMMING THE CHANNELS

Refer to Figure 1-10 for the following description.

This figure simulates the programming of Channel 2. Do not program this channel, just note the procedure outlined below in steps A, B, C, and D.

- A. Number 02 is the assumed channel number at Control R216 (X).

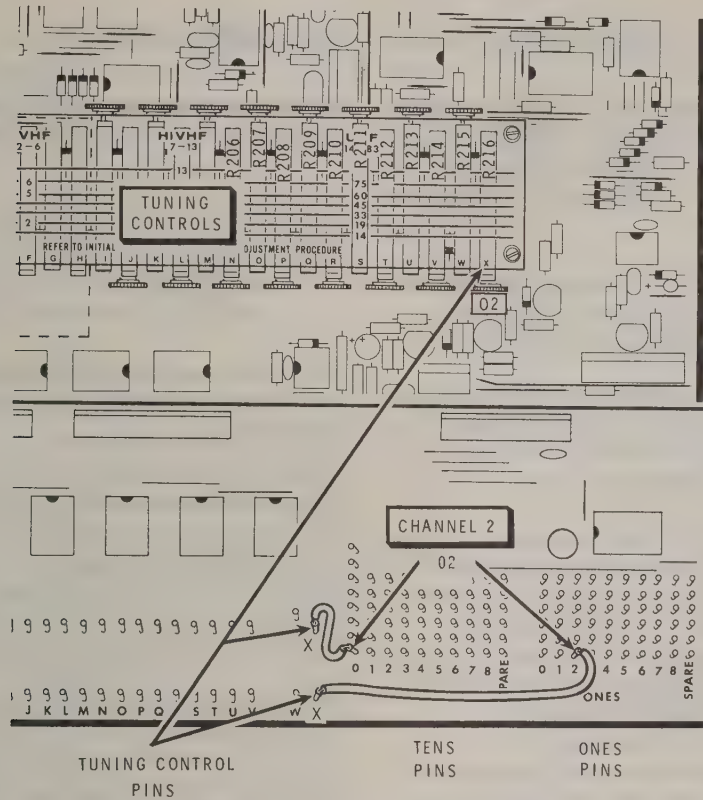
- B. Insert a jumper wire from TUNING CONTROL PIN X (top row) to pin 0 of the TENS PINS.
- C. Insert a jumper wire from TUNING CONTROL PIN X (bottom row) to pin 2 of the ONES PINS.
- D. Do not program the same channel more than once.

This would complete the programming of Channel 2.

NOTES:

1. Locate the white solid wire that was left over from the assembly. Use this for the jumper wires when you program the channels.
2. Before you cut each wire, lay it between the two points to obtain the correct length and allow 1/4" at each end to insert into the pins. The wire should also be long enough to allow for neat routing against the board. Where many channels are programmed, you can route the wires on top of each other. Figure 1-11 shows an example of the routing.

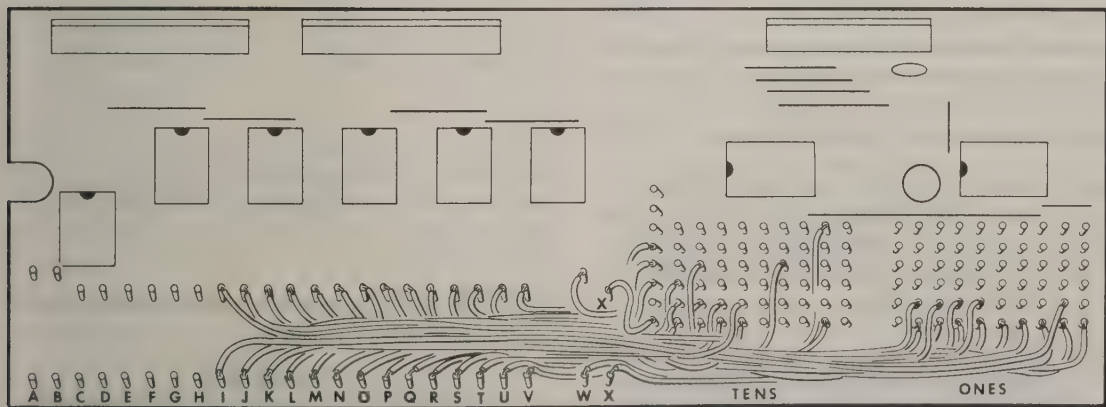
Now program each of the channels you have selected. Begin with the channel number at Control R216. NOTE: If you prefer, remove the channel selection circuit board and place it on your work surface when you install the wire.



PROGRAMMING EXAMPLE

Figure 1-10

THIS IS ONLY AN EXAMPLE



WIRE ROUTING EXAMPLE

Figure 1-11

PRELIMINARY ADJUSTMENTS

If any sign of malfunctioning appears in the following step, turn the set off and refer to the "In Case of Difficulty" section in Book 4. Prolonged operation of a malfunctioning TV Set could result in damaged transistors or components.

IMPORTANT: Do not adjust the brightness higher than necessary to provide a usable picture until you complete the convergence adjustments on Page 3-30.

NOTE: An occasional snapping (arcing) may be heard when the TV Set is first turned on. This is normal. The arcing occurs between the elements of the color picture tube during its initial aging process.

- () Remove transistor Q105, located on the AGC/SYNC circuit board, from its socket. Do not misplace the transistor. **NOTE:** With this transistor removed, the muting circuit is disabled. This means that the screen will not go black and the sound will not be squelched when you are switching channels.
- () Turn the TV Set on by turning the MASTER ON/OFF switch clockwise to the center of rotation. If the Set does not come on, push the INSTANT ON/OFF switch. After a few moments, a raster (light) should appear on the picture tube screen and sound or noise may be heard from the speaker when the VOLUME control is moved to the right. Do not attempt to tune in a station at this time. **NOTE:** A channel number may be blinking on and off also.

NOTE: Throughout the adjustments, turn the TV Set on and off with the INSTANT ON-OFF switch.

In some of the following steps, adjustments must be made at the rear of the TV Set while you watch the picture. It is easier to make these adjustments if a large mirror is placed so you can see the screen while you work at the rear of the Set.

WARNING: Voltage is present at several of the transistor cases throughout the TV Set. Be careful not to touch any of the transistors with metal cases while making adjustments in the following steps.

NOTE: Never remove or install transistors, integrated circuits, or circuit boards when the set is turned on.

- () Turn the TV Set off.
- () Connect a 10 Ω (brown-black-black) resistor between TP310 and TP311 on the IF amplifier circuit board as shown in Figure 1-12.

NOTE: This resistor will be left in until all the adjustments have been made. Do not remove it until you are instructed to.

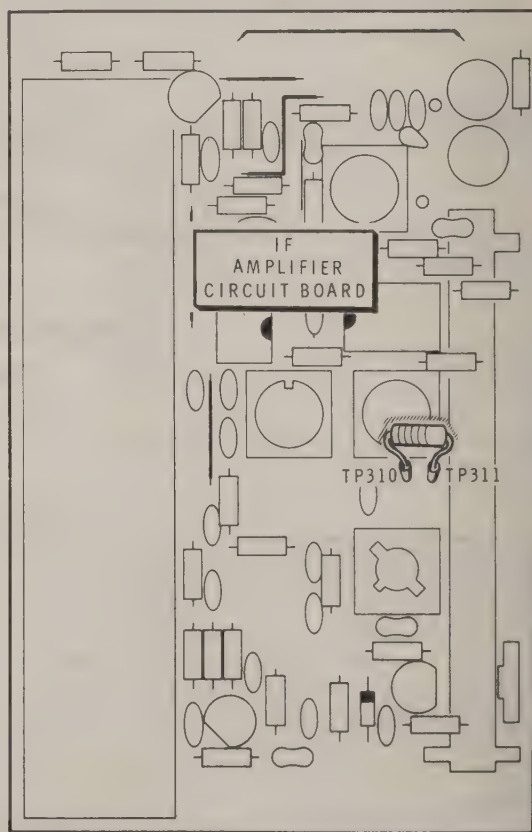


Figure 1-12

CHANNEL TUNING

You will only tune in one channel at this time so you can complete the remaining adjustments. The channel numbers are divided into three groups, with each group having a certain frequency range, as shown in the following chart.

<u>CHANNEL NUMBER</u>	<u>FREQUENCY RANGE</u>
2 through 6	LO VHF
7 through 13	HI VHF
14 through 83	UHF

Refer to Figure 1-13 (Illustration Booklet, Page 5) for the following steps.

Figure 1-13 shows the plastic window on the tuning control circuit board. This window has 7 lines drawn across it with numbers at different locations. The lines are the **approximate** locations for the red indicator of the tuning controls when the channels are being tuned in. The channels could be on the line or on either side of the line. The channels are divided into 3 frequency ranges. LO VHF, HI VHF, and UHF.

For ease of explanation, we will assume that the channels will be tuned in directly on the line. Figure 1-13 (Illustration Booklet, Page 5) shows three illustrations of the plastic window, one for each frequency range. Each illustration shows what lines are used for each group of channels. **EXAMPLE:** Channel 2 can be tuned in with any of the 16 controls on the second line, Channel 5 on the fifth line, and Channel 6 on the sixth line. Channel 3 would be tuned in between the second and third lines, and Channel 4 below the fourth line.

The HI VHF and UHF illustrations show what lines these groups of channels can be tuned in on, using the same procedure.

NOTE: If possible, choose a TV station that is 20 to 50 miles away for the following adjustments. If the station you have selected is unstable or snowy, refer to the "IF Adjustments" (Pages 3-39 and 3-40) and perform only the last step, the RF AGC control adjustment.

- () Turn the Tuning Control knob of the station you have selected until the red indicator is on the same channel number on the plastic window. **NOTE:** It is possible that the number you have programmed is between the lines.

CHANNEL KEYS

NOTE: You can select your channels by two methods. Number 1 below tells you how to use the channel number keys. Number 2 below tells you how to use the CHANNEL UP ▲ or CHANNEL DOWN ▼ keys.

- () Turn the TV set on.

1. () Press the channel keys for the channel you have chosen.
2. () When you press the CHANNEL UP ▲ key the channels are selected in increasing numerical sequence. When you press the CHANNEL DOWN ▼ key, the channels are selected in decreasing numerical sequence.
3. () Adjust the DISPLAY control on the video output circuit board counterclockwise until the channel number becomes visible on the screen. It will be necessary to keep the brightness at a minimum. **NOTE:** You may not have a picture, but the channel number should be displayed near the middle of the screen. For Channels 2 through 9, the 0 key should be pressed first, and then the channel number. However, the 0 will not be displayed on the screen.

INITIAL TUNING

Turn the Tuning Control knob in either direction to find the channel you want to select. The pointer on the control may be above or below the line on the dial window before a picture comes in. At this time there is no way of knowing if this is the correct channel or an adjacent channel. To find out, you can either wait for the channel to identify itself or check your local TV listing for the program that is supposed to be on at this time. **NOTE:** You may have to adjust the AGC control, on the front panel circuit board, slightly in either direction to obtain a picture. If the picture has diagonal lines (see Book 4, Page 4-11, Figures 2-16B, and 2-16C) adjust the HORIZ FREQ control on the horizontal oscillator circuit board. If the picture rolls (see Book 4, Page 4-10, Figure 2-14) adjust the VERT FREQ control on the vertical oscillator circuit board. Do not be concerned if the picture does not fill the screen on top or bottom. This will be adjusted later.

Note the two inset drawings on Figure 1-14 (Illustration Booklet, Page 5). One inset is for the top row of controls and the other inset is for the bottom row of controls. When you are instructed to tune in a channel, use the following procedure.

1. Turn the Tuning Control knob in the direction indicated until the picture starts to break up.
2. Then turn the knob in the opposite direction just enough to clear up the picture.

This completes the Initial Tuning.

NOTE: You will not have a normal picture at this time. See plate A on the fold-in (this is the large loose sheet of colored photographs in Book Four).

HORIZONTAL OSCILLATOR ADJUSTMENT

Refer to Figure 1-15 (Illustration Booklet, Page 5) for the following steps.

- () Turn the TV Set off.
- () Unplug the jumper wire going to test point TP570 on the horizontal oscillator circuit board.
- () Turn the TV Set on. The picture will now be out of sync with black bars moving across the screen. NOTE: The channel may have changed when you turned the TV Set on. If it did, reselect the channel you were on.
- () Adjust the HORIZ FREQ control until the black bars in the picture "float" slowly across the screen. See the photographs in Book 4 on Page 4-11 (Figure 2-16C, 2-16B, and 2-16A, in that order).
- () Turn the TV Set off.
- () Plug the jumper wire into TP570.
- () Turn the TV Set on. The picture should be locked in horizontally.

VERTICAL OSCILLATOR

- () Turn the TV Set off.
- () Refer to Figure 1-6 and unplug the jumper wire from TP525 on the vertical oscillator circuit board.
- () Turn the TV Set on. The picture should now be out-of-sync vertically and roll up or down on the screen.

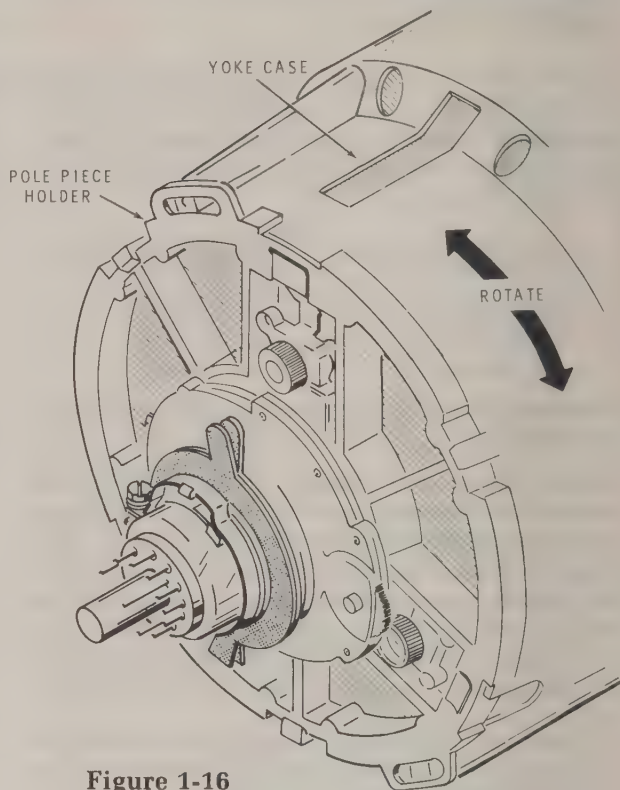


Figure 1-16

- () Carefully adjust VERT FREQ control R530 on the vertical oscillator circuit board until the picture "floats" slowly up or down on the screen. NOTE: This "float rate" should not be more than once every ten seconds.
- () Turn the TV Set off. Then plug the jumper wire back into TP525.
- () Turn the TV Set on. The picture should now be "locked in" vertically.



Figure 1-17

- () If the picture is tilted, straighten it by rotating the yoke case slightly. Do not rotate the pole piece holder. See Figures 1-16 and 1-17.
- () Turn the TV Set off.

The vertical height and centering adjustments will be made later.

HORIZONTAL LOCKOUT CIRCUIT CHECK

A special circuit has been incorporated on the horizontal oscillator circuit board. This circuit will detect an increase in the allowable high voltage rating for the TV Set. If the voltage gets too high, the picture will lose horizontal sync (diagonal lines). This immediately indicates a problem in the high voltage assembly and you must refer to Book 4, Page 4-46, to remedy the problem. Then return to this page and start again with this check.

The following check is a simulation of a high voltage problem to insure the proper operation of this circuit.

- () Turn the TV Set off.
- () Refer to Figure 1-15 and connect a short jumper wire between TP571 and TP572 on the horizontal oscillator board. **WARNING: Resistor R576 can get very hot; be careful not to touch it.**
- () Turn the TV Set on.
- () The picture should now be out of horizontal sync (have diagonal lines). Now turn the HORIZ FREQ control clockwise and counterclockwise. You **should not** be able to get the picture to come back into sync. If you were able to get the picture to sync, this circuit is not working and must be repaired before proceeding. Refer to Book 4, Pages 4-45 and 4-46.
- () Turn the TV Set off and remove the jumper wire.

This completes the circuit check. Now repeat the Horizontal Oscillator adjustment. Page 3-28.

KINE BIAS AND SCREEN CONTROL ADJUSTMENTS

The purpose of the adjustment in this section is to remove any predominant color shade that appears in the darker areas of a black and white picture.

In the following steps, colored lines will appear on the screen. If two lines of the same color appear, you should be concerned with only the straight line and not the curved or bowed line.

Refer to Figure 1-6 for the location of the controls in the following steps.

- () Set the KINE BIAS switch, located on the service circuit board, to position #3.
- () Turn the TV Set on.
- () Set the CONTRAST control fully counterclockwise.
- () Set the COLOR control on the front of the TV Set to DOWN.
- () Place the NORMAL-RASTER-SERVICE switch located on the luminance circuit board, to the S position. The overall picture tube screen should become dark. However, you may or may not have a thin horizontal line or lines across the center of the screen. If these lines are present, they will be red, green and/or blue.
- () Make sure the GREEN, RED, and BLUE GUN switches, located on the service circuit board, are turned on (down position).

NOTE: The GREEN, RED, and BLUE SCREEN controls that will be adjusted in the following steps, are located **on the chassis** at the rear of the TV Set just above the horizontal oscillator circuit board.

- () Turn each of the following controls fully counterclockwise: GREEN SCREEN, RED SCREEN, BLUE SCREEN. The picture tube screen should now be completely dark.

NOTE: If lines do not appear when you adjust any one of the three SCREEN controls in the following steps, place the KINE-BIAS switch in position #2 or #1. Leave the KINE-BIAS switch in the highest numbered position that permits proper adjustment of all three SCREEN controls.

- () Turn the RED SCREEN control clockwise until a red line just appears.
- () Adjust the FOCUS control, located under the high voltage assembly, for the sharpest line.
- () Turn the RED SCREEN control counterclockwise until the red line just disappears.
- () Turn the BLUE SCREEN control clockwise until a blue line just appears. Then turn it counterclockwise until the line just disappears.
- () Turn the GREEN SCREEN control clockwise until a green line just appears. Then turn it counterclockwise until the line just disappears.
- () Put the NORMAL-RASTER-SERVICE switch back in the N position.
- () Turn the CONTRAST and BRIGHTNESS controls for a usable picture.

FINAL ADJUSTMENTS

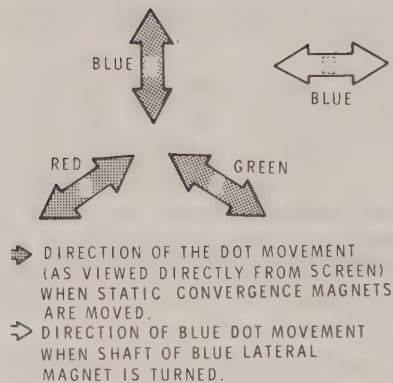


Figure 1-18

STATIC CONVERGENCE

Color dots from the dot generator circuits in this TV Set are placed on the screen for the following adjustments. The purpose of these adjustments is to converge the red and green dots together to make yellow dots in the center area of the screen; then to converge the blue dots with the yellow dots to make white dots in the center area of the screen. The static convergence magnets converge only the dots in the center area of the picture tube. Do not try to converge the dots in other areas at this time. When the magnet for the red dots is adjusted, it will cause the red dots to move diagonally. When the magnet for the green dots is adjusted, it will cause the green dots to move diagonally. The blue dots will move either vertically or horizontally. They will move vertically when the static magnet for the blue dots is adjusted and horizontally when the blue lateral magnet is adjusted. Figure 1-18 shows the direction of dot movement.

Refer to Figure 1-6 for the location of the controls called out in the following steps.

1. () Make sure the NORMAL-RASTER-SERVICE switch on the luminance circuit board is in the N position.
2. () Make sure the GREEN, RED, and BLUE GUN switches on the service circuit board are turned on (down).

3. () Select a strong station. Make sure the COLOR control is in the extreme left position.
4. () Adjust the BRIGHTNESS control counterclockwise, but not until it clicks.
5. () Adjust the CONTRAST control fully counterclockwise.
6. () Set the DOTS-NORMAL switch on the display circuit board to the DOTS position.
7. () If there is light on the screen, adjust the BRIGHTNESS MINIMUM control on the luminance board until the background is dark.
8. () Adjust the DISPLAY control on the video output circuit board for the sharpest dots and lowest possible brightness, but still have the dots visible.
9. () Set the BLUE GUN switch on the service circuit board to the OFF position.
10. () Check the screen. If blue dots are still visible, adjust the DISPLAY control on the video output circuit board clockwise until they just disappear.

NOTE: If you are unable to perform the RED, GREEN, or BLUE static magnet adjustments in the following steps, refer to the "In Case of Difficulty" Manual, Book 4, Page 4-21.

11. () Adjust the RED static magnet clockwise while you view the screen. As you turn the magnet, the red dots will move in one direction. As you continue to turn the magnet clockwise, the dots will begin to move in the other direction. Adjust the magnet until the dots are in the center of this range.
12. () Similarly adjust the GREEN static magnet.

13. () Adjust the RED and GREEN static magnets to make the red and green dots form yellow dots in the center of the screen. See Photo B.
14. () Turn the BLUE GUN switch on.
15. () Adjust the BLUE static magnet by using the same method that was used with the RED magnets in step 11.

For the following steps, refer to Figure 1-19 (Illustration Booklet, Page 6), that shows your type of blue lateral and purity assembly to locate the blue lateral adjustment knob.

16. () Turn the BLUE lateral knob clockwise and then counterclockwise, and note the amount of blue dot travel in each direction. Adjust the knob so the dots are in the center of this range.
17. () Adjust the BLUE static and BLUE lateral magnets to make the blue dots merge with the yellow dots at the center of the screen. There should now be white dots at the center of the screen. See Photos C and D.
18. () Readjust the red or green dots slightly, if a red or green line appears at one edge of the white dots.
19. () Place the DOTS-NORMAL switch in the NORMAL position and adjust the CONTRAST and BRIGHTNESS controls for a viewable picture. If a color broadcast is tuned in, make sure the COLOR control is DOWN.
20. () Check the picture at the center of the screen. If there is a blue fringe of 1/2" or more around an object, it is an indication that the blue dots are not converged properly with the red and green dots. Perform steps 21 through 25 if this is the case. Otherwise, disregard steps 21 through 25 and proceed with the Focus Adjustments.
21. () Set the DOTS-NORMAL switch to the DOTS position.
22. () Adjust the CONTRAST control fully counterclockwise.
23. () Adjust the BRIGHTNESS control counterclockwise, but not until it clicks.

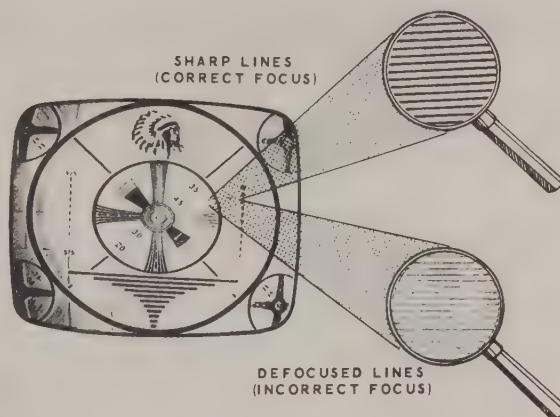


Figure 1-20

24. () While you observe the center of the screen, adjust the blue static magnet to place the blue dots up one row or down one row.
25. () Now repeat steps 9 through 20.

FOCUS ADJUSTMENT

The Focus control, which will be adjusted in the following step, is located on the bottom of the high voltage assembly as shown in Figure 1-6.

- () First turn the FOCUS control clockwise and counterclockwise while viewing the picture and note the effects this has. Adjust the Focus control for the sharpest separation between the trace lines in the center of the picture as shown in Figure 1-20. You may find that you have to get quite close to the picture to see these individual lines and to judge when they are most sharply defined. NOTE: It is not necessary to have a test pattern for this adjustment.

HEIGHT AND VERTICAL CENTERING ADJUSTMENT

The following controls are located on the vertical oscillator board.

- () Turn the HEIGHT control clockwise or counterclockwise until you can see both the top and bottom of the picture (about 1/2" of black showing).
- () Adjust the CENTERING control so the picture is centered top to bottom on the screen.
- () Turn the HEIGHT control counterclockwise until the top and bottom of the picture disappear.

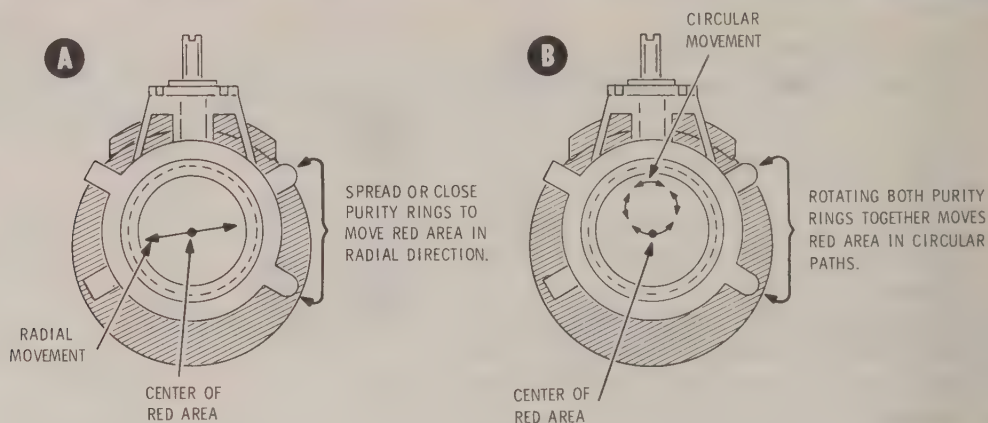


Figure 1-21

PURITY ADJUSTMENTS

NOTE: Due to the earth's magnetic field, the following adjustments should be made with the front of the picture tube facing either a north or south direction.

The purpose of the purity adjustment is to align the electron beams so the red beam strikes only the red phosphor dots on the screen, the green beam strikes only the green dots, and the blue beam strikes only the blue dots. This adjustment removes impure color areas from the screen.

To remove the channel numbers from the screen during these purity adjustments, remove the jumper wire from the constant display pin on the display circuit board. The display will go off in approximately 30 seconds. Changing channels will cause the numbers to reappear again for approximately 30 seconds.

- () Remove the jumper wire from the AUTO RECALL pin on the display circuit board.
- 1. () Place the NORMAL-RASTER-SERVICE switch in the R position.
- 2. () Refer to Figure 1-19 and position the purity rings so that the two round-end tabs point straight up before starting these adjustments.
- 3. () Place the BLUE GUN and GREEN GUN switches to the OFF position.
- 4. () Loosen the two wing-head screws that secure the deflection yoke in the yoke case. Pull on these screws to move the deflection yoke back as far as possible in the yoke case.

Refer to the large fold-in sheet in Book 4 when you are instructed to look at a color photo in the following steps.

- 5. () Refer to Photos E and F. If a red area is not visible as shown in either of these photos, push the yoke forward as far as possible.
NOTE: If the red spot appears very dim, turn the RED DRIVE control clockwise slightly. This control is located on the video output circuit board.

NOTE: The following adjustments will be easier to make if the room lights are dimmed. The movement of the yoke is the coarse adjustment, and the movement of the purity rings is the fine adjustment of color purity.

- 6. () Turn the purity rings until you obtain a **red area in the center of the screen**. See Photos E and F. Spreading the tabs apart or pushing them closer together moves the red area in a radial direction as shown in Figure 1-21 Part A. Rotating both purity rings in the same direction (maintaining the space between the tabs) moves the red area in a circular path as shown in Figure 1-21 Part B. **NOTE:** First, move only one ring about an inch in either direction; then move both rings in the same direction to move the red area toward the center of the screen. It may be necessary to increase or decrease the spread between the tabs. The tabs may end up in any position around the neck of the tube when the best results are finally obtained. Finally, adjust each of the rings separately to move the red area to the center of the screen.

NOTE: Perform step 7 if the yoke was positioned back as in step 4. Perform step 8 if the yoke was positioned forward all the way as in step 5.

7. () Slowly move the yoke forward. Stop when the screen is entirely red. See photo G. Re-adjust the purity rings if necessary to obtain a pure red screen.
8. () Slowly move the yoke backward. Stop when the screen is entirely red. See photo G. Re-adjust the purity rings if necessary to obtain a pure red screen.
9. () Tighten the two wing screws on the deflection yoke.

NOTE: If you cannot obtain a pure red screen, set the DOTS-NORMAL switch to DOTS and the GREEN and BLUE GUN switches to the ON position. Then, re-check the static convergence. Make sure the dots in the center of the screen are still white. If they are not white, repeat the "Static Convergence" adjustments on Page 3-30. Then repeat previous steps 3, 5, 6, 7, and 8. It may be helpful, as a more exact method of checking purity, to look at the screen with a magnifying glass. When only the red beam is turned on, as in the adjustments above, only the red dots should be illuminated. The green dots and blue dots may be re-checked in the same manner if the green and blue guns are turned on individually. If good purity cannot be achieved, it may be necessary to repeat the "Degaussing" on Page 3-17. CAUTION: Do not place the degaussing coil near the pole piece assemblies or the blue lateral and purity assembly while power is applied to the coil. These components are located at the rear of the yoke assembly.

- () Turn the RED DRIVE control to the center of rotation.
- () Place the NORMAL-RASTER-SERVICE switch in the N position.

- () Place the BLUE GUN and GREEN GUN switches to the ON positions.

- () Reinstall the jumper wire in the CONSTANT DISPLAY pin on the display circuit board.

DYNAMIC CONVERGENCE ADJUSTMENTS

The adjustments in this section should be performed twice to obtain the best dynamic convergence. Go through all the steps in the "Dynamic Convergence" section the **first** time to obtain **approximately** the correct merging of dots. The second time you go through these steps, you will be more familiar with the procedure; thus, good dynamic convergence will be much easier to attain.

These adjustments converge the red, blue and green dots into white dots at those areas away from the center of the screen. First, the red and green dots are converged to obtain yellow dots along the vertical line and along the horizontal line passing through the center of the screen. Then the blue dots are converged with the yellow dots to obtain white dots along the vertical and horizontal lines.

Do not try to get **perfect** convergence at all corners of the screen, since this cannot be realized. Careful examination of any color receiver will show slight misconvergences, especially near the corners of the picture. When all the dots appear as pure white at a normal viewing distance (at least five feet away), the convergence can be considered to be satisfactory.

NOTE: Improper static convergence could prevent you from obtaining proper dynamic convergence in the following steps. If the center area of the screen becomes misconverged while performing the dynamic convergence steps, go back and repeat the "Static Convergence." Then continue with dynamic convergence.

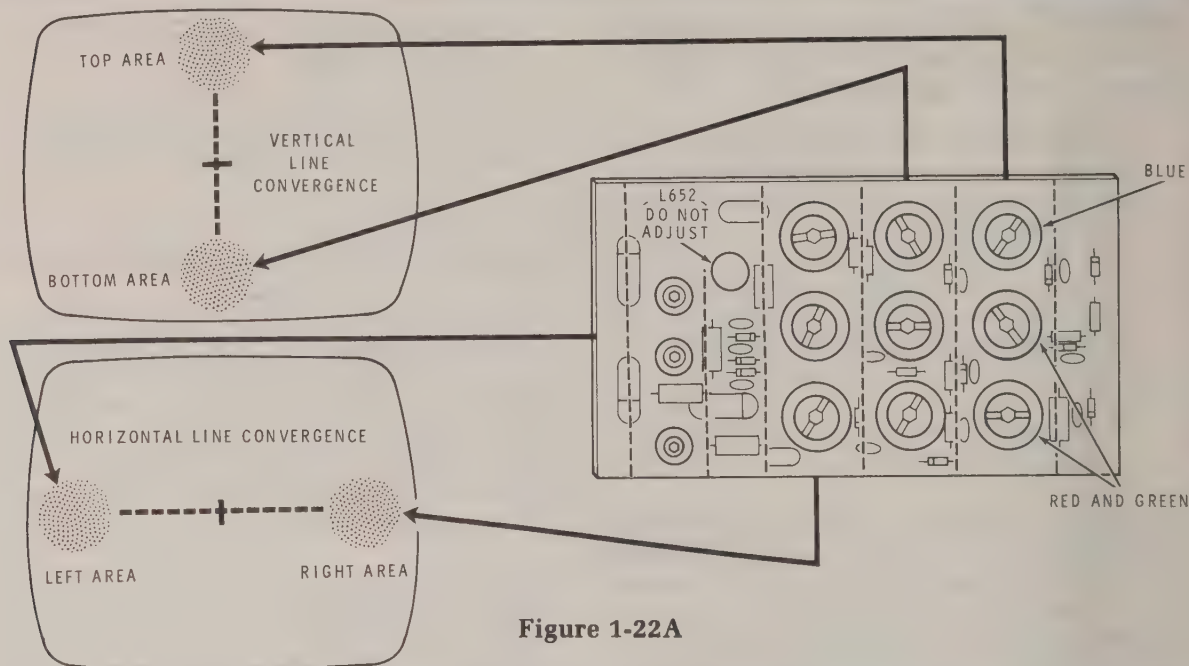


Figure 1-22A

Note that the convergence circuit board is divided into four rows of controls and coils. Figure 1-22A shows the area of the screen converged by each row of controls.

- () Turn off the blue gun by placing the BLUE GUN switch in the OFF position.
- () Place the DOTS-NORMAL switch to the DOTS position.
- () Turn the CONTRAST control counterclockwise.
- () Turn the BRIGHTNESS control down until the background is dark.

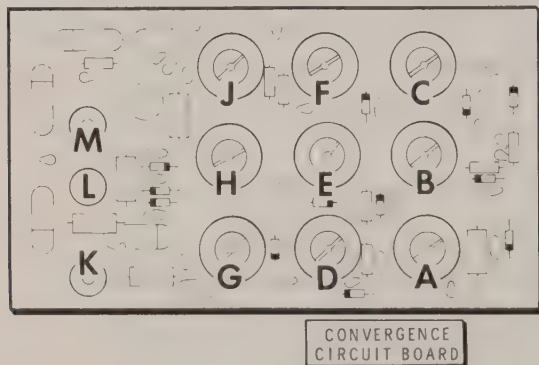


Figure 1-22B

Since a certain amount of interaction will occur between the controls, it will be necessary to repeat the following steps several times before the dots become converged in all areas.

Refer to Figure 1-22B for the location of the controls on the convergence circuit board; then perform the steps in Figures 1-23 and 1-24. Use the plastic alignment tool supplied with this kit to adjust coils K, L, and M. Do not adjust coil L652. If a piece of tape is available, place it over the coil hole. Do not use any metallic tape.

- () Check all of the dots in the **vertical line** in the top and bottom areas. Make sure that all red and green dots are merged to form pure yellow dots. If the dots near the center of the screen are not properly converged, readjust the red and green static convergence magnets; then repeat the steps in Figure 1-23. See Photos B, H, and J on the fold-in sheet in Book 4.
- () Check all the dots in the **horizontal line** in the left and right areas of the screen. Make sure that all red and green dots are merged to form pure yellow dots. If the dots near the center of the screen are not properly converged, readjust the red and green static convergence magnets, then repeat the steps in Figures 1-23 and 1-24. See Photo K.
- () Recheck the vertical and horizontal rows of dots. If necessary, repeat the steps in Figures 1-23 and 1-24.
- () Place the BLUE GUN switch to the ON position.

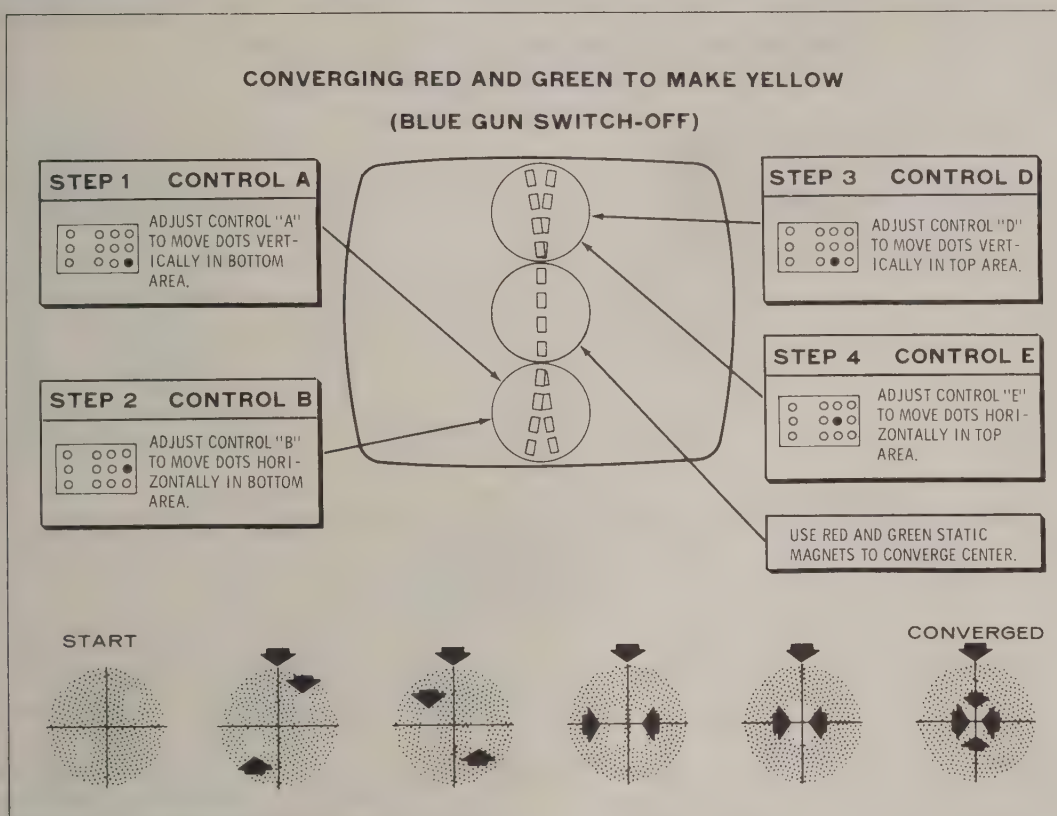


Figure 1-23

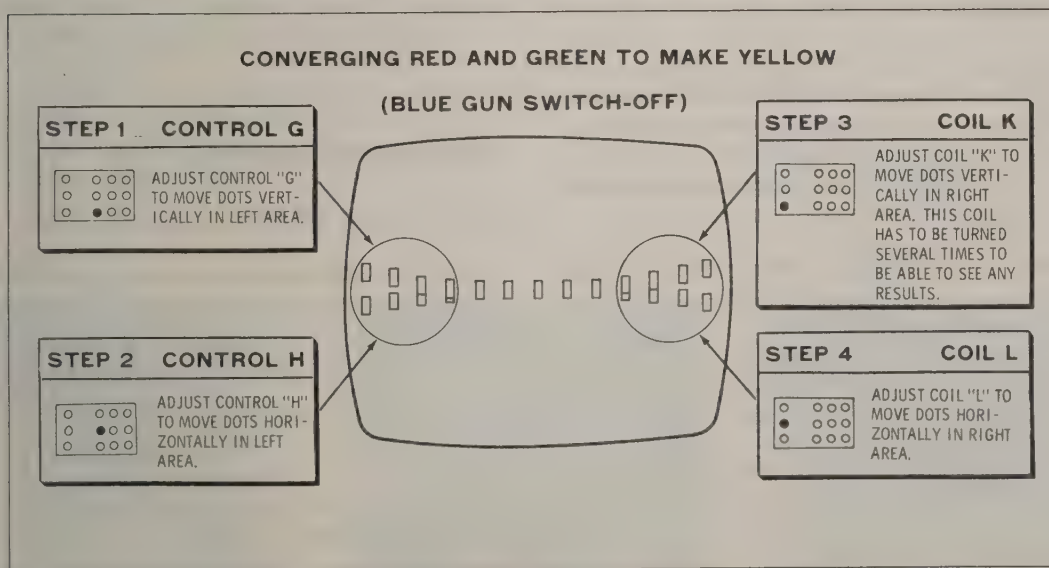


Figure 1-24

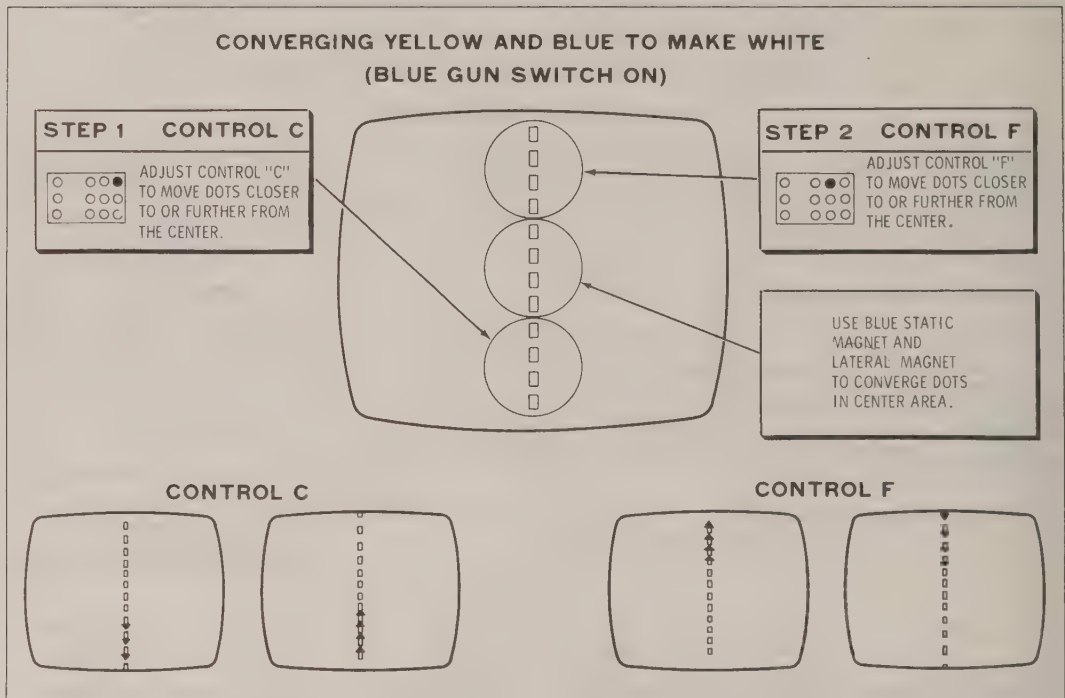


Figure 1-25

Perform the steps in Figure 1-25 to merge the blue dots with the yellow dots to make white dots in the top and bottom areas. See Photo L.

- () Check all the dots in the center vertical row to make sure they are all white. If the blue dots at the center of the screen are not properly converged, readjust the blue static convergence magnet and the blue lateral magnet, then repeat the steps in Figure 1-25.

Perform the steps in Figure 1-26 to merge the blue dots with the yellow dots in the right and left areas. See Photo M.

- () Check all the dots in the center horizontal row to make sure they are all white. If the blue dots at the center of the screen are not properly converged, readjust the blue static convergence magnet and the blue lateral magnet; then repeat the steps in Figure 1-26.
- () Place the DOTS-NORMAL switch to the NORMAL position.

- () Adjust the BRIGHTNESS and CONTRAST controls for the best picture.

- () Recheck the Focus Adjustment (Page 3-31).

PINCUSHION ADJUSTMENTS

Refer to Figure 1-6 for the following steps.

NOTE: The pincushion adjustments in the following steps affect the top and bottom of the picture. When you make the adjustments, watch the rows of dots closely to observe the changes.

- () Place the DOTS-NORMAL switch in the DOTS position.
- () Adjust the CONTRAST control fully counterclockwise.
- () Turn the BRIGHTNESS down until the background is dark.

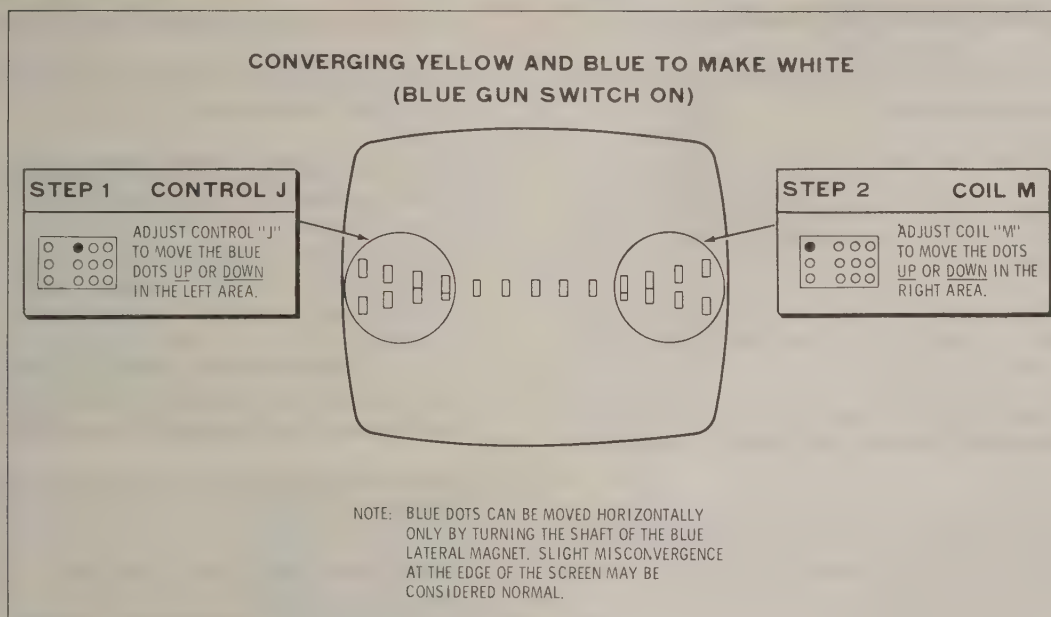


Figure 1-26

- () Turn the PINCUSHION AMP control, located in the bottom right corner of the service circuit board, fully clockwise. Note that there is a slight bow in the top and bottom horizontal row of dots. See Figure 1-27. NOTE: The Figures show a white line to accentuate the bow. However, there will not be a white line on your screen.
- () Adjust PINCUSHION PHASE coil L602, located on the service circuit board, until the outward bow in the top horizontal row of dots moves to the middle of the screen.
- () Turn the PINCUSHION AMP control counterclockwise until the top horizontal row of dots are straight when your eyes are level with these rows of dots. See Figure 1-28.
- () Place the DOTS-NORMAL switch in the NORMAL position.
- () Adjust the DISPLAY control on the video output board for the desired number brightness.
- () Readjust the BRIGHTNESS and CONTRAST Controls for a viewable picture.



Figure 1-27

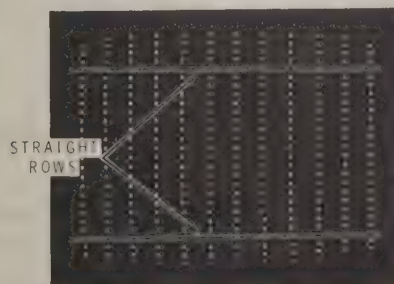


Figure 1-28

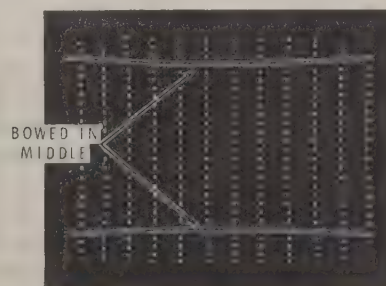


Figure 1-29

BRIGHTNESS LIMITER ADJUSTMENT

Refer to Figure 1-6 for the location of the adjustments in the following steps.

- () Turn the TV Set off.
- () Place the NORMAL-RASTER-SERVICE switch on the luminance circuit board in the S position.
- () Make sure the Troubleshooter FUNCTION switch is set to VOLTS and the RANGE switch is set to 5.
- () Connect the black lead of the Troubleshooter to the ground strap on the picture tube socket.
- () Connect the red lead of the Troubleshooter to the pin marked "TP" on the luminance circuit board. The pin is located near the BRIGHTNESS LIMITER control as shown in Figure 1-6.
- () Turn the TV Set on.
- () Adjust the BRIGHTNESS control fully counterclockwise (but not until it clicks).
- () Adjust the BRIGHTNESS LIMITER control on the luminance circuit board for a 1-volt reading on the Troubleshooter.
- () Disconnect the Troubleshooter test leads.
- () Place the NORMAL-RASTER-SERVICE switch in the N position.
- () Reset the BRIGHTNESS and CONTRAST controls for a normal picture.

GRAY SCALE ADJUSTMENTS

The Screen and Drive controls will be adjusted to remove any apparent color shading from a black and white picture. **Keep in mind that the SCREEN controls affect the shade of the low light areas of the picture, and that the DRIVE controls affect the high light areas of the picture.** For example, if a dimly lit background scene is predominantly green, the GREEN SCREEN control should be turned down slightly. If a bright area is predominantly green, the GREEN DRIVE control should be turned down slightly.

- () Tune in your strongest local station.
- () Make sure the COLOR control is set to the extreme left position.
- () Set the NORMAL-RASTER-SERVICE switch to the S position.
- () Turn the GREEN, RED, and BLUE SCREEN controls located on the chassis, fully counterclockwise.
- () Turn the GREEN screen control up until a green line appears; then turn the control back to that point where this line just disappears.
- () Repeat this procedure with the RED and BLUE SCREEN controls.
- () Reset the NORMAL-RASTER-SERVICE switch to the N position.
- () Alternately adjust the RED DRIVE, BLUE DRIVE, and GREEN DRIVE control until the shade of the picture is black and white.

3.58 MHz OSCILLATOR ADJUSTMENT

- () Set the COLOR control to the extreme right position.
- () Turn the COLOR KILLER control, located on the front panel circuit board, fully clockwise.
- () Set the NORMAL-ADJUST switch, located on the color oscillator circuit board, to ADJUST. Horizontal bars of red, green, and blue will now appear on the screen.
- () Adjust APC control located on the color oscillator circuit board **very slowly** until the color bars become wider and fewer in number. If the bars begin to increase in number again, you have turned the control too far. Return the control to its center of rotation and begin again. Continue adjusting the control until the entire picture is predominantly one color. The color may drift slowly from red to green to blue.
- () Return the NORMAL-ADJUST switch to the NORM position. The picture should now appear in color.
- () Adjust the COLOR control for a normal amount of color. See Photo N.

ACC ADJUSTMENT

Set the NORMAL-ADJUST switch, located on the color oscillator circuit board, to ADJUST.

NOTE: Test points TP476 and TP477, which will be used in the next step, are located on the color oscillator circuit board to the right of the APC control. See Figure 1-6.

- () Set the Troubleshooter to the 5 volt range. Connect the black lead of the Troubleshooter to TP476 and the red lead to TP477.
- () Adjust the ACC control for a 0 meter reading.
- () Remove the red lead and touch the red lead to TP477 and notice the movement of the meter needle. The movement may be very slight.
- () Touch TP477 a number of times with the red lead and adjust the ACC control until there is no movement of the meter needle when the test point is touched.
- () Disconnect the meter leads and return the NORMAL — ADJUST switch to the NORMAL position.

COLOR KILLER ADJUSTMENT

The color killer circuit will be adjusted to ensure that color programs are reproduced in color, and black and white programs are free from colored confetti (small flashing colored spots caused by noise). See Photo P.

- () Set the COLOR control for a normal amount of color.
- () Press one of the channel selector pushbuttons until you receive an unused channel and check to see if any colored confetti appears on the screen. NOTE: If you cannot find an unused channel, select any channel. Then locate the tuning control for this channel and turn it slightly so the picture is snowy.

- () If colored confetti appears, turn the COLOR KILLER control counterclockwise until the colored confetti just disappears. Switch to your programmed station to make sure the color signal is still received normally. It may be necessary to readjust the COLOR control on the front of the set to get a normal amount of color.

BRIGHTNESS MINIMUM ADJUSTMENT

Tune in a station.

- () Turn the BRIGHTNESS control counterclockwise to the point just before it clicks. The TV Set will be on, but the screen may be dark.
- () Turn the CONTRAST control fully clockwise.
- () Adjust the BRIGHTNESS MINIMUM control for a dark screen; then turn the control in the opposite direction until the whites in the picture just become visible.
- () Turn the BRIGHTNESS control fully clockwise to make sure there is sufficient brightness. If an adequate brightness level cannot be obtained, repeat the previous step but make the whites slightly brighter.
- () Readjust the BRIGHTNESS and CONTRAST controls for a normal picture.

IF ADJUSTMENTS

NOTE: If in the future it is ever necessary to repeat the IF Adjustments, be sure to install the 10 Ω resistor between TP310 and TP311 on the IF circuit boards.

- () Turn the AFT switch and the MUTE switch on the front panel OFF.
- () Select a strong VHF or UHF station. (Make sure the station is tuned in properly.)

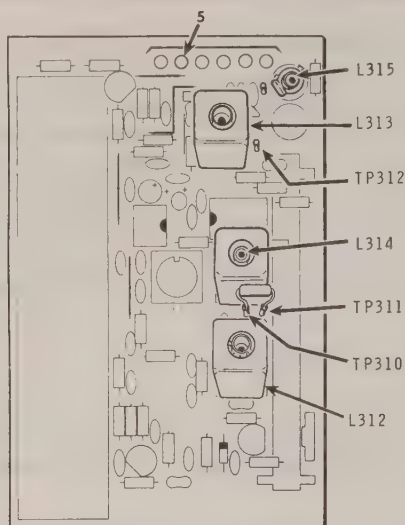


Figure 1-30

Refer to Figure 1-30.

- () Set the VOLT RANGE switch to 50.
- () Connect the black test lead to the metal ground strap coming from the picture tube socket. Connect the red test lead to pin 6 of the AGC/SYNC circuit board. The meter reading should be 9 volts.
- () Remove the 10 Ω resistor from between TP310 and TP311. NOTE: The picture may be mistuned after the resistor is removed. This will be taken care of in the next three steps.
- () Turn the RF AGC control on the AGC/SYNC circuit board until you get a reading just below 5 volts. Then set the VOLT RANGE switch to 5. Now adjust the RF AGC control for an approximate 4.5 volt reading. The picture may appear snowy.
- () Insert the short end of the plastic alignment tool into the core of coil L314 on the IF circuit board. Adjust the coil clockwise or counterclockwise for the lowest meter reading.
- () Disconnect the troubleshooter test leads.
- () Turn the RF AGC control, located on the AGC/SYNC circuit board, counterclockwise until snow (white specks) appears in the picture. Then, turn the control clockwise to the point where the snow just disappears.

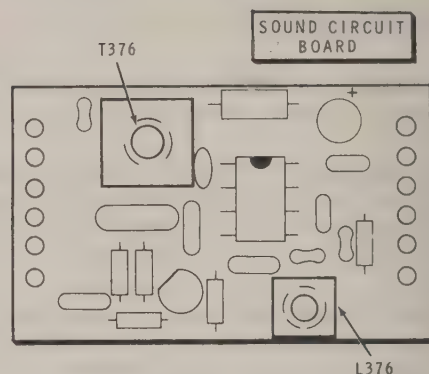


Figure 1-31

SOUND ADJUSTMENTS

Refer to Figure 1-31 for the following adjustments on the sound circuit board.

- () Adjust the VOLUME UP until you hear sound from the speaker.
- () With a strong station tuned in, use the plastic alignment tool and adjust L376 for the loudest sound from the speaker, with the least amount of noise and buzz.
- () Disconnect the antenna leads from the antenna terminals and place the lead **near** the terminals so you can hear the sound, but noise (hiss) is also present.
- () Refer to Figure 1-31A and adjust both slugs of T376 for the best sound with the least amount of noise from the speaker. As the sound improves, move the antenna leads farther away and repeat the adjustment.
- () Adjust the cores of coils L312 and L313 for the best sound. See Figure 1-30.
- () Reconnect the antenna lead.

4.5 MHz TRAP ADJUSTMENT

- () Turn the TV Set off.

Refer to Figure 1-30 for the following steps.

- () Disconnect the lead from TP312 and insert it into pin 5 of the IF circuit board.
- () Turn the TV Set on. The picture will not appear normal.
- () Set the VOLUME UP until you hear sound from the speaker.
- () Adjust the core of coil L315 with the plastic alignment tool for the most noise and distortion from the speaker. It should not be necessary to turn the coil more than two turns in either direction. NOTE: You may want to install a piece of tape on the tool to use as an indicator.

- () Disconnect the lead from pin 5 of the IF board and insert it in TP312.

TINT ADJUSTMENT

- () Set the front panel COLOR control for normal color.
- () Set the front panel TINT control to the center of its range.
- () Adjust coil L451 on the chroma circuit board for natural flesh tones. Use the plastic alignment tool.
- () Turn the TV Set off.

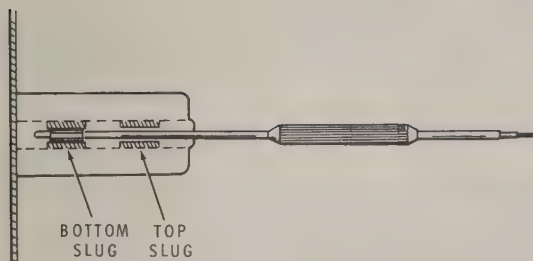


Figure 1-31A

FINAL TUNING

NORMAL TUNING CHARACTERISTICS:

1. When you press the first digit of a channel number, the screen will go black and the sound will mute. Since transistor Q105 has not been reinstalled on the AGC/SYNC circuit board, the screen will not go black and the sound will not mute.
2. If you do not press the second digit of a channel number above 10 within approximately 3 seconds, you will have to press both numbers again.
3. You can use two methods when selecting Channels 2 through 9:
 - A. Press 0 and then the channel number;
or
 - B. Press only the channel number, and the picture will come on in approximately 3 seconds.

In the following steps, you will tune in all of the remaining channels that you have programmed. Use the procedure outlined below for each channel. (This is the same procedure you used to tune in the one channel in the "Initial Channel Tuning.")

1. Make sure the AFT switch (SW755) is OFF.
2. Press the channel number.
3. Turn the tuning knob until the red indicator is on the same channel number on the plastic window. If the number falls somewhere between the lines, turn it to the approximate location.
4. Refer to the applicable inset drawing on Figure 1-32 (Illustration Booklet, Page 6) and turn the tuning knob in the direction indicated until the picture starts to break up.
5. Turn the knob in the opposite direction just enough to clear up the picture. If you turn the knob too far, the color will disappear.

Tune in each of the channels, using the procedure outlined above. NOTE: Start with the first tuning control on the right side, R216, and refer to the "Normal Tuning Characteristics" below.

- () Press either CHANNEL switch, go through all the programmed channels, and select the strongest one. Then touch up the AGC and RF AGC controls as follows:

1. Turn the AGC control (on the front panel circuit board) clockwise until the picture tears or starts to bend. Turn the control counterclockwise until the picture clears up and then bends and tears again. Set the control between these two points.
2. Turn the RF AGC control, located on the AGC/SYNC circuit board, counterclockwise until snow (white specks) appears in the picture. Then turn the control clockwise to the point where the snow disappears and the picture is clear.

CHANNEL DISPLAY

Refer to Figures 1-1 and 1-6 (Illustration Booklet, Pages 1 and 2) for the following steps.

- () Adjust the DISPLAY control on the video output circuit board for the brightness level of your choice.
- () Adjust the HORIZ POS and VERT POS controls to put the display at whatever location you want it on the screen.

The channel numbers are now displayed continuously on the screen when your TV Set is on. If you would rather have them displayed intermittently, perform the following steps.

- () Unplug the jumper wire from the CONSTANT DISPLAY pin. Position the end of the wire away from other parts.
- () Make sure the jumper wire coming from hole A is plugged into the AUTO RECALL pin.
- () Adjust the AUTO RECALL TIME control fully clockwise.
- () Adjust the DISPLAY TIME control fully clockwise.

DISPLAY TIME

This control determines how long the display will stay ON.

Fully counterclockwise  — The display is on for the **shortest** length of time.

Full clockwise  — The display is on for the **longest** length of time.

- () Push the channel UP ▲ or channel DOWN ▼ key.
- () Observe the display and notice how long it stays on. You may want to check the time with the second hand of your watch. Record this time next to this step.
- () Adjust the control fully counterclockwise and again check the length of time the display is on.
- () Now you know how long the display stays on in both positions. Decide how long you want the display to stay on, and set the control to that approximate position.

AUTO RECALL TIME

This control determines how long the display will stay off.

Fully clockwise  — The display is off for the **shortest** length of time.

Fully counterclockwise  — The display is off for the **longest** length of time.

- () Check the display to see how long it stays off and record the time next to this step.

- () Adjust the control fully counterclockwise and again, check the length of time it is off and record the time next to this step.

- () Now you know how long the display stays off in both positions. Decide how long you want the display to stay off, and set the control to that approximate position.

NOTE: The automatic recall can be disconnected by unplugging the AUTO RECALL hookup wire.

SCAN SPEED

This control determines how long the picture is displayed on the TV screen as you switch channels with the channel UP ▲ or channel DOWN ▼ keys.

Fully clockwise  — The picture is on for the **longest** length of time.

Fully counterclockwise  — The picture is on for the **shortest** length of time.

Choose a channel you want to watch. The object of this adjustment is to set the scanning speed so that, when you release the channel UP ▲ or channel DOWN ▼ key (for the channel you have chosen), it will not scan past it, but stop on the correct channel.

- () Adjust the SCAN SPEED control fully counterclockwise.
- () Push either the channel UP ▲ or the channel DOWN ▼ key and hold it in until you reach the channel you have chosen. Then release the key. Now adjust the SCAN SPEED control clockwise slightly and repeat this step until you have found the correct scanning speed.

AFT ALIGNMENT

- () Turn the TV Set off.
- () Make sure the AFT switch on the front of the set is in the ON position.

NOTE: Before you remove the transistor in the following step, carefully note the position of each transistor lead. Then, be sure to position the leads correctly when you replace the transistor.

- () Remove transistor Q167 from its socket on the U-V switching circuit board. See Figure 1-6.
- () Open the chassis door far enough to allow access to the AFT assembly.

NOTE: Voltage is present at several locations on the chassis door. Use extreme care during the following adjustments.

Refer to Figure 1-34 (Illustration Booklet, Page 6) for the following steps.

- () Connect the red lead of the Troubleshooter to terminal 3 on the AFT assembly.
- () Connect the black lead of the Troubleshooter to lug 6 of connector G.
- () Make sure the meter FUNCTION switch is set to VOLTS and the VOLTS switch is set to 50.
- () Using the plastic alignment tool, turn the core of coil L352 three turns counterclockwise as viewed from inside the chassis door.
- () Turn the TV Set on and select a strong vhf or uhf channel. It may be necessary to slightly readjust the appropriate tuning control to get the best picture on the screen.
- () Now adjust coil L351 for the lowest reading on the Troubleshooter.

NOTE: In the following step, as you adjust coil L352 clockwise, the meter reading will decrease and then suddenly rise. The correct setting will be as close as possible to 5 V.

- () Adjust coil L352 clockwise (as viewed from inside of the chassis door) to obtain as close to a 5 V meter reading as possible.
- () Set the Troubleshooter to the 5 VOLT range.
- () Readjust coil L352 slowly to obtain as close to a 5 V meter reading as possible.
- () Turn the TV Set off.
- () Replace transistor Q167 in its socket on the U-V switching circuit board.
- () Disconnect both meter leads from the AFT assembly.
- () Close the chassis door and replace the screw previously removed. Then refer to Figure 1-6 and secure the chassis door with two additional #6 $\times$ 3/8" sheet metal screws.
- () Turn the TV Set on.
- () Turn the AFT switch off and readjust the appropriate tuning control for the best picture.
- () Turn the AFT switch on and off while you view the picture; the color should not change. If it does change, turn the AFT on and readjust L352 again for the best picture. L352 can be reached through the access hole between the IF board and the luminance board. See Figure 1-6.
- () Now recheck the AFT action again by turning it off and on while you view the picture. Repeat the adjustment of L352 if necessary.

- () Switch to several programmed channels, and make sure the tuning control is adjusted to bring in the best picture for each channel. Then, turn the AFT switch on and observe the picture. The picture should stay properly tuned-in when the AFT switch is turned on.
- () If the picture becomes detuned when the AFT switch is turned on, repeat the entire AFT Alignment section.

Refer to Figure 1-6 for the following steps.

- () Select the strongest programmed uhf channel.
- () If the picture appears snowy, adjust the UHF-AGC control counterclockwise until the snow disappears. This control is located on the U-V switching circuit board.
- () Check both sides of the screen. If you can see a black edge on one side or the other, adjust the HORIZONTAL CENTERING control on the service board until it disappears.

Refer to Figure 1-3 and, while you view the picture, adjust the PEAKING control clockwise or counterclockwise to see what effect it has on the picture. Then set the control for the best receivable picture.

- () Refer to Figure 1-6 and, on the power supply circuit board, cut the jumper wire from the TDR676 thermistor. IMPORTANT: Perform this step carefully to avoid cutting the thermistor leads.

MUTE ADJUSTMENTS

The mute circuit will turn off the picture and sound when you switch from channel to channel, and when you select an unused channel, or a weak channel.

The following controls and switches are located on the front panel circuit board and the front panel of the TV Set.

- () Reinstall transistor Q105 on the AGC/SYNC circuit board. Refer to Book 1, Page 1-35, the last step in the left-hand column to install the transistor.
- () Set the VOLUME so you can hear the sound.
- () Set the AFT switch to ON.
- () Set the MUTE switch to OFF.
- () Set the MUTE ADJUST control (R157) fully counterclockwise.
- () Disconnect the antenna or tune to a weak station.
- () Set the MUTE switch to ON.
- () Adjust the MUTE ADJUST control until the screen just goes dark and the sound cuts off.
- () Reconnect the antenna and check each channel. The picture and sound should be muted as you switch. If the picture and sound are muted on strong channels, set the MUTE ADJUST control counterclockwise slightly until the picture and sound comes in.

This completes the Tests and Adjustments.

ANTENNAS

INTRODUCTION

This section will provide you with information concerning antennas, antenna lead-in (twin lead and shielded cable), proper antenna orientation, and signal preamplifiers for fringe areas. This information will help you select the proper antenna installation for maximum performance from your Color Television Set.

TYPES OF ANTENNAS

Your Color TV Set is designed to operate with one of the broadband types of antennas such as the inline types recommended for color TV reception. It is very important to use an antenna which is suited for your area. Indoor antennas and some of the outdoor types of antennas that are used satisfactorily with black and white TV sets do not provide sufficient signal pickup and bandwidth for color television. The impedance of the antenna can be either 300 Ω or 75 Ω .

ANTENNA LEAD-INS

The color television signal is carried from the antenna to the television set by a length of 300 Ω twin lead or by a 75 Ω shielded (coaxial) cable. The most commonly used types of twin lead and shielded cable are listed, with a description of how they respond to weather conditions.

NOTE: Figure 1-35 (Illustration Booklet, Page 7) shows how to connect the following three types of twin lead to the antenna terminal strip.

300 Ω flat twin lead — Little signal loss in fair weather. High signal loss in wet weather, especially at uhf frequencies.

300 Ω tubular twin lead — Little signal loss in fair weather. Less signal loss in wet weather than with flat twin lead. Better for uhf than flat twin lead.

300 Ω encapsulated twin lead — Little signal loss in fair weather. Less signal loss in wet weather than with tubular twin lead. Better for uhf reception than flat and tubular twin lead.

The signal loss may be even greater with the preceding three types of twin lead if they have accumulated a noticeable amount of foreign matter (dirt, chimney soot, etc.). Also, do not route these types of lead inside a metal pipe or within 5 inches of any metal surface.

300 Ω shielded twin lead — Slightly more signal loss in fair weather than the preceding three types of twin lead. However, it has the following advantages over the other twin leads: Very little signal loss in wet weather, less affected by local interference, lasts much longer, no standoff insulators needed to keep it away from antenna tower or pole, can be routed inside of metal pipe. Excellent for TV reception (color or black and white) and stereo-FM reception. Figure 1-35B shows how to connect this twin lead to the antenna terminal strip.

Be careful to route shield leads as shown so they cannot contact any connector.

75 Ω low loss shielded cable — This cable has the same characteristics as the 300 Ω shielded twin lead. When a 75 Ω cable is used, a 75 Ω antenna should be used. Figure 1-35E shows how to connect a cable to the vhf antenna terminals and 300 Ω twin lead to the uhf terminals of this Heath TV Set. If you have a single 82 channel, 75 Ω lead-in, you must use a vhf-uhf splitter as shown in Figure 1-35D.

CATV or master systems — The CATV antenna connection is shown in Figure 1-35C. The uhf stations are converted to the unused vhf channels; therefore, uhf connections are not used. Master systems used in motels or hotels are similar and use the same antenna connections.

82 channel 300 Ω — This single lead-in requires a splitter and is connected as shown in Figure 1-35F.

ANTENNA ORIENTATION

Antennas often need more careful orientation for good color TV reception than for black and white reception. Some antenna positions could result in good black and white pictures, but poor color pictures. This is mainly because the color information is transmitted differently than the black and white information. If a new antenna is being installed, or if the position of an older antenna seems questionable, orient it during a color program for best reception.

If the antenna is not oriented properly, signals from several directions may be reaching the antenna at the same time. These signals are usually reflected from objects such as large buildings or large metal structures. The reflected signals may cause slight phase shifts in the television signal. On black and white pictures, this would result in a very slight ghost (a duplicate image appearing next to the actual image) or smear. On color pictures, however, the phase shift can cause excessive color smear and incorrect color areas. To eliminate this problem, turn the antenna until the best picture is received.

Distorted pictures can sometimes be caused by too strong a signal, especially in metropolitan areas, where the transmitting antenna is quite close to the receiving antenna. In these cases, the signal from the antenna can be reduced by using an attenuator pad. Figure 1-36 shows two types of attenuator pads: one for 75 Ω antenna impedance and one for 300 Ω antenna impedance. Select the correct pad for your antenna impedance and connect it between the antenna and the Color TV Set, as shown. Resistors for making these pads can be obtained locally.

SIGNAL PREAMPLIFIERS

If you live in a fringe area where it is difficult to receive a strong TV signal, a preamplifier may be a solution to your problem. A preamplifier will amplify the weak signal received by the antenna. If you purchase a unit of this type, make sure the specifications qualify it to be used for color as well as black and white signals. If the bandpass specifications are too narrow, a phase shift could occur which could cause color smear and incorrect color areas (a black and white picture would not be affected).

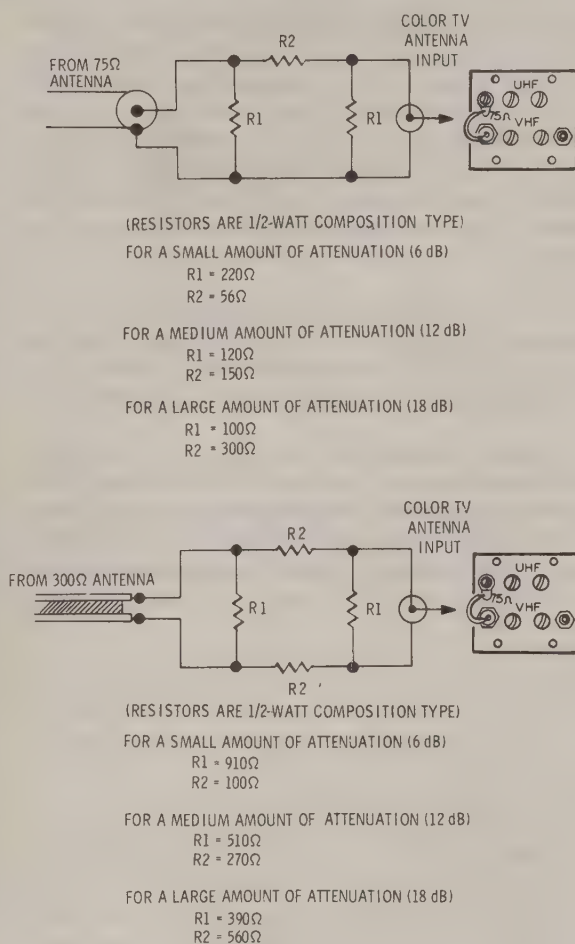


Figure 1-36

There are two types of preamplifiers: outdoor and indoor. The outdoor type will be described first.

The **outdoor** preamplifier is mounted on the antenna mast near the antenna. The antenna is connected to the input terminals, and the lead-in is connected to the output terminals. The other end of the lead-in is connected to the antenna terminal strip. The power supply which supplies operating voltages for the preamplifier is mounted in the house, and the voltages are fed up to the unit through a cable.

The main advantage in using an outdoor preamplifier of this type is that only the TV signal from the antenna is amplified and not the noise generated in the lead-in. This gives a better signal-to-noise ratio and less snow in the picture. NOTE: Make sure that the lead coming from the antenna is not routed next to the lead coming from the preamplifier. This could cause the preamplifier to oscillate and cause interference in the picture.

The indoor preamplifier is installed inside the house between the antenna and TV Set. This unit amplifies the signal as well as the outdoor unit, however, any noise generated in the lead-in is also amplified.

The **indoor** preamplifier is a good unit to use for couplers when more than one TV set is used. This type of unit can usually be purchased with more than one set of output terminals. Additional TV sets can be connected to these terminals. This would serve as an

amplifier stage for each TV set, and also keep the sets from interfering with each other.

When using preamplifiers as multi-set couplers in strong signal areas, the input of the preamplifier (depending on the circuitry) may be overdriven. This would result in cross-modulation problems in the preamplifier and cause interference on one or more channels. Be sure to use an attenuator pad in these cases, such as the one shown in Figure 1-36, on the input of the preamplifier to reduce the amount of signal to the preamplifier.

NOTE: Many preamplifiers are more receptive to interference than the TV receiver. If your TV indicates interference, first disconnect the preamplifier and check the reception without it. If this eliminates the interference, an appropriate filter may be used in the lead-in going into the preamplifier from the antenna.

OPERATION

Do not place antenna controls, electric clocks, telephones, etc., on top of the cabinet of your Color TV Set. These devices can produce undesirable magnetic effects that could distort the colors on the picture tube screen.

Refer to Figure 1-37 (Illustration Booklet, Page 7) for information about each operating control. Then refer to Photo R through Photo U on the fold-in for pictures that show the effect of misadjusted Tint and/or Color controls. Photo S is a normal color picture. Photos R and T show what happens if the TINT control is turned too far in either direction. Photo U shows what happens if the COLOR control is advanced too far.

All of the color pictures on the fold-in are actual unretouched photographs of the screen of the Heath Color TV Set. The faulty pictures were artificially induced in the TV Set by engineering personnel of the Heath Company. Permission to reproduce the program material was given by WGN TV, Chicago, Illinois.

Tune in a color TV program and adjust the various front panel controls and switches to become familiar with their effect on the color picture.

COLOR PROGRAMS

There are many variables that affect the quality and intensity of the colors and the sharpness of the images shown on the picture tube screen. In general, live programs and some color film will produce better pictures on your TV Set screen than programs that have been recorded on video tape. Color programs that are televised outdoors may appear quite different

from programs televised indoors due to the differences between natural light and artificial light. Quite often, slight differences can be seen between signals from different TV cameras on the same program.

Color quality may change when you tune from one channel to another. It may be necessary to readjust the COLOR and TINT controls when you tune in a color program, or when you switch channels.

You may sometimes see slight color fringes around objects that are near the corners of the picture tube. A small amount of this "color fringing" is normal for color TV receivers. Color fringing can be caused by slight misconvergences between the red, blue, and green beams in the picture tube. This would also be noticeable on black and white pictures.

When you judge the quality of the color picture, be sure you consider the source of the program before you decide that there is a problem in the TV Set.

AGING IN

After one or two weeks of operation, repeat the "Dynamic Convergence Adjustments" on Page 3-33. This time period will allow for the initial "aging in" which most color TV receivers must go through before the components stabilize. After readjusting the dynamic convergence circuits, the Set will require only slight readjustments from time to time to maintain optimum performance. The horizontal and vertical oscillator circuits may also require minor readjustments at the same time.

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

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